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Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

March Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, March 1, 1895.

The March meeting of the Society of Gas Lighting will be held at the works of the Mutual Gas Light Company, of New York, 11th street and Avenue D, on Thursday, the 14th inst., at 3 P.M.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

Eleventh Annual Meeting, Ohio Gas Light Association.

OFFICE OF THE SECRETARY, COLUMBUS, O., March 4, 1895.

To the Members of the Ohio Gas Light Association: The eleventh annual meeting of the Ohio Gas Light Association will be held in the parlors of the Arcade Hotel, Springfield, O., March 20th and 21st, 1895, for which occasion the following papers will be prepared:

"Changing the Arrangement of a Retort House, and the Practical Benefits Derived Therefrom," by Mr. A. F. Nash, Windsor, Ont.

"Prepayment Gas Meters," by Mr. Jno. D. McIlhenny, Phila., Pa.

"Cannel Coal as an Enricher," by Mr. Graham Macfarlane, Louisville, Ky.

"Incandescent Burners," by Mr. H. Wilkiemeyer, Evansville, Ind.

"What Proportion Should Holder Capacity Bear to Maximum Output?" by Mr. E. T. McCormack, London, Ohio.

"The Growth of a Gas Plant," by Mr. E. C. Gwyn, Springfield, Ohio.

"Carbide of Calcium," by Mr. Henry L. Doherty, Columbus, Ohio.

"Hints on Handling Gas Stoves," by Mr. Charles V. Newman, Peoria, Ills.

"Soft Coal Water Gas," by Mr. W. S. Bowen, Louisville, Ky.

Members are requested to come prepared to take active part in discussions of the foregoing, and of the "Question Box" also, to which they are asked to contribute. The meeting will open at 10 A.M. Wednesday, March 20th. Headquarters will be at the Arcade, but first-class accommodations can also be secured at the Lagonda House, at both of which places special rates will be made for members of the Association.

Application blanks for membership can be secured of the Secretary, who will be pleased to give any information desired.

A. P. LATHROP, Secretary.

BRIEFLY TOLD.

PRESIDENT SEDGWICK DEAN'S ADDRESS BEFORE THE MICHIGAN ASSOCIATION.—With this number we complete our report of the proceedings of the second annual meeting of the Michigan Gas Association, and our readers, we think, will agree with us in the verdict that the meeting was a most valuable one; for the papers were on live topics, and their authors seemingly had no difficulty in going right to the heart of the matters they commented upon. The literary gem of the collection, however, must be credited to Mr. Sedgwick Dean, the President of the Association, whose inaugural address is as pithy a communication as one could wish for. There can be no doubt of the great significance to the gas business of his reference to what seems to be a permanent advance of "one cent per gallon in the price of refined carbon oil," for, as he well remarks, that small factor of a dollar represents an increase big

in percentage to the one who depends on oil for artificial illumination —and it is percentage which tells in the long run, particularly when the percentage is big on a little factor. Apart, however, from his references to the actual state of the gas trade, in our view, his arraignment of the electric current as a source of fire danger is worthy of the closest attention; nor may his findings thereto be gainsaid, since these are built on the records of the 28th annual meeting of the National Board of Fire Underwriters, which body ought to be considered impartial—as at least between the supplying of gas and electricity. Far too little attention has been given by the gas interests to this feature of a competing business, the managers of which have been outspoken always in claiming superior virtue for their system in this direction. The beauty, too, of Mr. Dean's argument is that it is dispassionate.

OBITUARY NOTE, MR. WILLIAM TARBELL.—Our issue for February 25th contained a brief notice of the death of Mr. Wm. Tarbell, whose demise occurred at his home in Waltham, Mass., on the evening of February 15th. We are now enabled, mainly through the attention of his son (Mr. A. W. Tarbell) to put the following brief record of his life before our readers. William Tarbell was born in Mason, N. H., on July 4, 1824, and received his education in the public school of that town. In 1836 he went to Springfield, Mass., where he learned the trade of a tinworker, which he subsequently followed in various Eastern centers, notably in Lawrence, Worcester and Milford, Mass., removing to the last named place in 1864. In 1868 he was appointed Saperintendent of the Milford Gas Light Company, a post held by him until 1876, when he engaged in the stove and hardware business. During his management of the Milford Company the number of consumers was doubled, and notable additions were made to the plant. In 1877 he accepted the position of Superintendent to the Waltham (Mass.) Gas Light Company, a position that he filled acceptably until his retirement therefrom in 1887. When he took charge of the Waltham Company's business the annual output was about 6,000,000 cubic feet, the consumers numbered 400, the leakage was 33⅓ per cent., and $3.70 per 1,000 cubic feet was the selling rate. At the end of his term the output was 25.000,000 cubic feet, the consumers numbered 750, the leakage was 7 per cent., and the selling rate was $2 net. The works, too, were practically rebuilt, but, of course, on a greatly enlarged scale. During the last year of his service at Waltham the Company installed an electric plant, with a capacity of 100 arc and 400 incandescent lamps. He was progressive in his ideas, and possibly this fact led to the difference between his employers and himself which resulted in the tendering and acceptance of his resignation. He was one of the first to advance the idea in Massachusetts that gas companies should favor the placing of gas stoves by supplying gas at a lower rate for fuel consumption than for illuminating use. He joined the New England Association of Gas Engineers, at the 1874 meeting, and was a frequent and welcome attendant at its sessions. During the past few years he was concerned in the construction of the gas plants at the American Watch Company's factory, at Middleboro and South Framingham, Mass., and at Laconia, N. H. He also overlooked some special work for the city of Waltham, in the line of street construction and the laying out of a new parkway. He was united in marriage to Miss Mary A. Noyes, of Amherst, N. H., January, 1850, who survives him. The funeral services were held in Waltham on February 19th, the Reverend H. A. Philbrook officiating. The mourners present included a representative delegation from the New England Association of Gas Engineers, which body also forwarded a beautiful floral token. Interment was made at Mount Feake.

At the organization meeting of the Board of Directors of the Lancaster (Pa.) Gas and Edison Electric Light Companies (the Directors of each are identical), the officers chosen were: President, J. I. Hartman; Secretary, John H. Baumgardner; Treasurer, John C. Carter; Executive Committee, John H. Baumgardner, H. S. Williamson and J. G. Zook. Another important step taken was the revision of the gas rate schedule, the change to date from March 1st. The new rate for illuminating gas is $1.50 per 1,000 cubic feet; $1.40 for manufacturing purposes;" $1 for fuel use. The old net rate was $1.60 per 1,000 all round.

AT the annual meeting of the New Jersey Gas Improvement Company, of Mount Holly, N. J., the following officers were elected: President, Geo. W. Schreiner; Vice-President, Frank Mitchell; Secretary and Treasurer, S. R. Gaskill; Engineer, Fred. C. Viney.

COL. FRANK S. RICHARDSON, President of the North Adams (Mass.) Gas Light Company, sails for Bermuda, per steamship Trinidad, on Wednesday morning. The trip is for pleasure, of which may he have a round measure.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONCLUDED FROM PAGE 298.]

TWENTY-FIFTH ANNUAL MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

HELD AT THE PARKER HOUSE, BOSTON, MASS., FEB. 13 AND 14, 1895.

SECOND DAY—MORNING SESSION.

The President announced that the next topic for consideration would be—

CARBIDE OF CALCIUM: ITS ADVANTAGES AS A GAS MAKING MATERIAL AND AS AN ENRICHER,

and called upon Secretary Prichard to start the discussion.

The Secretary—This topic was introduced into the order of the meeting from the desire of some members to learn more about the material, as they thought it was a possible feature in the coming gas business, perhaps, if not a probable one. I have a little sample of it here that we made very crudely. This was made, as the most of it is, from coke dust and powdered lime. It was placed in a furnace, about 2 inches in diameter and 3 inches deep, and through it we passed an alternating current. The intense heat of that current fused and combined these two elements, and we had as the result carbide of calcium, which is a very close, dense material, so hard that you can hardly break it with a hammer. It has a strong odor of acetylene. If it is immersed in water, gas is given off at once and it can be lighted. So that all you will have to do in the future, to make gas at your gas works, is to have plenty of water handy. Other gentlemen here, who are far better posted than I am about it, can give you the chemical facts about the material.

The President—We would be glad to have Mr. Hinman take part in this discussion.

Mr. Hinman—Carbide of calcium is interesting, from a gas man's standpoint, simply as a source of acetylene. The principles involed in the manufacture of acetylene by this process are both electrical and chemical. The composition of the carbide of calcium, which is the compound described and shown by Mr. Prichard, is supposed to be the following: One atom of calcium combined with two atoms of carbon. This of itself gives no gas at all; but when it is mixed with water decomposition takes place. Calcium has a great affinity for oxygen and it takes that away from the water—water being composed of two atoms of hydrogen and one of oxygen. That leaves the hydrogen, as you might say, free; but the moment it becomes free it combines with the carbon, so that it forms the compound known as acetylene, composed of two atoms of carbon and two atoms of hydrogen. Acetylene is a substance with which you are all probably familiar. It is one of the illuminants in both coal gas and water gas, although it does not occur in very large percentage in either—in fact, much less than 1 per cent. The following are some of the properties of acetylene of most interest to the gas man: It has various processes. The specific gravity is quite high, nearly that of air, 0.91; it is somewhat soluble in water; that is, water absorbs about its own volume of this gas; when at the freezing point of water it is condensed into a liquid by pressure something less than 50 atmospheres. I do not know that it is the lightest known liquid, but it is pretty near it—the specific gravity of liquid acetylene being only 0.4 that of water. The heat of combustion of this acetylene is not very great as compared with other illuminants on account of the small number of atoms of carbon and hydrogen that it contains. I think the combustion of 1 foot gives about 1,500 heat units; common coal or water gas giving from 600 to 700. That of benzole, for example, which is another illuminant, would be 2½ times as much as acetylene. Now, leaving out of account the question whether this acetylene can be prepared cheaply or not, other considerations have to be taken into account. In what I state about the candle power I am only retailing information I have received, having made no experiments myself; but I am told that the candle power is something like 240, when burned at the rate of 5 feet per hour. This is a pretty large statement, but it has been made, and possibly it is correct. Benzole (according to its molecular formula) contains three atoms of acetylene compressed into one, and it should give, according to that view of it, three times as much light; but I believe that according to the best authorities (Frankland and Thorne) it gives less than twice as much (466 candles). It has been proposed to use this acetylene in various ways. Perhaps the best and most practical application of it is as an enricher for either common coal gas or for water gas, or it can be used in small gas works to take the place of oil gas, it being mixed with air, or to take the place of the vapor of naphtha in gas machine gas. There are one or two objections to it, one of which

is that acetylene forms with copper a compound which attacks all brass fittings, forming a substance which is quite explosive. Another objection is that the gas is so easily absorbed by water that if you add only a small amount of it to coal gas, the water in your pipes and in your drips and in the mains and in the holders, would absorb its own volume of acetylene. Then, too, if it came largely into use as an enricher, so as to form a large proportion of the gas, and you depended upon it for giving the illuminating power to your gas, such gas would not be of much use for gas heating purposes—the heat of combustion is so small relatively to its illuminating power. It is a very handy way of enriching your gas, as all that you have to do is to put a little lump of the calcium carbide into water and make your acetylene and with it enrich your gas. That is the way I view it.

The President—We are under great obligation to Mr. Hinman for giving us this talk. Is not Mr. McKay familiar with this matter?

Mr. McKay—I received a letter from the Secretary respecting this subject, but wrote to him that I had had no practical experience with it in any way; and this sample which he has brought here is the first commercial carbide of calcium that I have seen. From the exhibition which the Secretary gave of it, it seems necessary to hold a match to it to make it burn all the time. It seems to me that, from the commercial point of view, so far it is a great pity that the subject had not been discussed before Mr. Lamson's paper was read, as he might have continued his dream for another day, and might have taken this in.

The President—Possibly we may hear from that next year. Is any other member familiar with this substance? I think that to most of us it is a new subject. I see that Dr. Wilkinson is present, and as I think he must know a great deal about this material, we would all be glad to have him enlighten us with regard to it.

Dr. Wilkinson—Gentlemen: I do not know that much more can be said on the subject. From earliest history of gas manufacture acetylene has been considered a very desirable article to have in coal gas. The coal gas that was first made from rich cannel coal contained from one-half to about 2 per cent. of acetylene. You will find, on reading almost any of the old books on gas manufacture, that acetylene was looked upon as a very desirable article; but the attempt to produce it on a commercial scale has only recently been made. In the making of aluminum, where we use coke, lime and clay, it was discovered that a substance was made which, when thrown into water, gave off a gas, and which, upon applying light, took fire. This substance was examined and found to be the carbide of calcium. In the days of Sir Humphrey Davy carbide of calcium was known; so that it is not entirely a new article. All that is new about it is the possibility of producing it on a commercial scale. It requires the high heat of the electric current to cause the combination of calcium, which is the basis of lime, and carbon. Now that we are making aluminum on a large scale, this as a bye-product possibly may be of great interest. Where there is wasted water power you may possibly be able to make this very cheaply—as, for instance, at Niagara Falls, where they use the water power for making electricity at night for the various towns in that locality. In the daytime, having no use for electricity, they could use that power for making this carbide of calcium, and possibly could make it very cheaply. You will find various statements made as to its value in producing gas, and some of them are to the effect that you can make from 10,000 to 15,000 feet of gas from a ton. Its value would of course depend upon the purity of the article. If you are making it as a bye-product in the manufacture of aluminum the article will not be very pure, because there is a certain quantity of silicic acid that must be got rid of; but with pure caustic lime and pure coke dust, you would then have the cost of the lime, the cost of the coke and the handling of the material to make up the expense of production. It is claimed that possibly this might sell for $3 or $5 per ton. Now, you all know the price of a ton of lime, the price of a ton of coke dust and the cost of handling these things. It can be made cheaply on a very large scale; and as a bye-product it might possibly be manufactured a little cheaper. So there is the possibility that we have now within our reach a substance to enrich coal gas aside from petroleum oil. That in itself is a very interesting fact. We do not require such a large percentage of this substance to make a very high candle power. From the experiments which I have made I will say that 2 or 3 per cent. added to coal gas will increase its candle power from 16 to 20 candles, and, at the same time, we are getting a clear, white light. With water gas I was greatly disappointed in the experiments made with this gas, for even 30 per cent. of acetylene failed to enrich the gas to 20 candles. You are aware that natural gas is almost completely light carbureted hydrogen; 5 or 6 per cent. of acetylene will enrich that to 20 candles, and it will burn clear and bright. In this country, where naphtha is so cheap, it would be hard to compete with it; but in England, where naphtha is more expensive, this substance may be of great use. In small places, where they make coal gas alone, and would like to have a higher candle power, a little of this substance will increase the candle power with very little trouble. You see from the experiment made to-day that you have only to introduce it into water and the gas is at once given out. The resulting compound left behind is merely slacked lime. So that, by throwing a given quantity of this carbide of calcium into water, a given quantity of gas is driven off. This may be added before the purifiers, or afterwards, for it is perfectly pure. When manufactured in a commercial way it is possible there may be a little sulphureted hydrogen or phosphureted hydrogen present, but the quantity would be so small as not to interfere. When made, the gas can be compressed to a liquid, and then, as the pressure is released, it will instantly spring back to gas, without loss of candle power. I see it is reported that it will give possibly 200 candles. I have not been able to get as high as that; but it is very much higher than gas made from oil—probably double. For the lighting of cars in place of Pintsch gas it will be a very desirable thing. To enrich poor coal gas it is very desirable, as also to enrich natural gas. It remains for those who have the process in hand to produce this substance so cheap that we gas men can use it. Of course, at the present prices, it is out of the question; but at from $5 to $10 per ton, or equal to the price of cannel coal, it would be very desirable. I do not know that there is anything more I can say about it. A company in New York have taken this subject up and propose to furnish carbide of calcium on a commercial scale. When they do, we will have an opportunity to learn more about it. Chemically it is one of the greatest curiosities of the day.

Mr. Taber—Will Dr. Wilkinson tell us what the equivalent is for a ton of this article in candle feet, or in cubic feet?

Dr. Wilkinson—So far as that is concerned, I can only say it depends upon the purity of the material used. If you are using pure coke dust and pure caustic lime you will have a very pure article, which will yield from 10,000 to 15,000 feet per ton; but if you are making it as a bye-product you introduce foreign substances, such as silica (for you know aluminum is made from silicate of aluminum), and there you will have an impurity which will reduce the quantity of gas made to probably one-half; so that it will depend entirely upon the purity of the material that you use. If they were making it commercially, and without any regard to the making of aluminum, they could produce a very pure article.

Col. Armington—How would you store this after it was made? Would you store it in the solid form, or reduce it to the liquid?

Dr. Wilkinson—Let me say that carbide of calcium has a great affinity for water. Like caustic lime, it will air-slack—it will give up its gas from the moisture derived from the air—consequently it will have to be sent to you in sealed cans or barrels, so that moisture may be kept entirely from it. When you throw it into water it will liberate gas, and you can store it in that way, or you can compress it with pumps. Of course, you can store it in the holder first, then compress it with pumps into cylinders for use on cars; or, if you want it simply to enrich coal gas, you can store it in the holder. If you want to enrich 1,000 feet of coal gas 5 per cent., 1 pound of this will give you 5 feet or 2 feet, according to its purity. You add that, and allow it to pass in with your coal gas. Being a perfect gas it will, by diffusion, unite with your coal gas, and so, in a very short time, you will see the increased candle power. Two or three per cent. added to ordinary 16-candle coal gas will bring your candle power up from 16 to 22 or 23 candles.

Mr. McKay—Will Dr. Wilkinson give us some information respecting the explosibility of a mixture of this gas with air, and as to the explosibility of the copper compound which may be deposited.

Dr. Wilkinson—As far as the gas itself is concerned, they have proposed to use it for the air gas machines instead of using naphtha. Now in the ordinarily constructed air gas machine you want about 50 per cent. of the vapor of gasoline and 50 per cent. of air. It is found that about 40 per cent. of this substance will make a very high candle power, and that the gas will burn well in an open burner. Of course, like all hydrocarbon gases, you can make an explosive compound of it; and before you have reached the stage of highest illumination you can form an explosive compound. More than that, of course, it would burn with a smoky flame. As regards its action on copper, I may say that in the old gas works a good deal of copper tubing was used, and it was noticed that there was deposited inside of the copper tubing a compound which, when struck by a hammer, would explode. After that people were very careful in handling the old copper tubing from gas works, for it would explode almost equal to gunpowder when struck or when heated; this forms with copper a compound which is explosive, as it does also with brass. It also forms an explosive compound

with silver. These are all well known explosive compounds. But in our ordinary works I do not think we need anticipate any trouble from that source, as the small amount of copper that we have in our stopcocks would not be sufficient to cause any difficulty. The use of copper piping about our works is a thing of the past. So in that respect I do not think we have anything to fear.

Mr. Hinman—I would like to ask Dr. Wilkinson if at the time he made the examination of the candle power of this gas he determined the composition of the gas, and whether there was any sulphur present in the mixture or gas that came up.

Dr. Wilkinson—I will say this: You know it is not always possible to have pure gas. The compound that you will get with hydrogen and sulphur will make an impure gas. There are always present impurities, and one of the impurities is most likely to be a sulphide. The sulphide of calcium when added to water will produce sulphureted hydrogen. It is also possible that you may have phosphorus present, and that will give you the phosphide of calcium, that when thrown on water will give you phosphureted hydrogen, which will take fire when exposed to the air. It is what is known as the "will of the wisp." Phosphureted hydrogen is given off wherever organic matter is undergoing decomposition. It is not likely to be present, but you will understand that if your lime is not pure (if you use oyster shell lime) a great deal of organic matter is present.

Mr. Addicks—I would like to ask Dr. Wilkinson a few questions. First, if this carbide of calcium is shipped in sealed vessels, what effect a rise in temperature would have; secondly, a comparison of present prices of the carbide as compared with naphtha, either at 4, 5, 6 or 7 cents per gallon.

Dr. Wilkinson—Of course you know the parties who have this thing in hand contemplate its manufacture on a commercial basis more cheaply than present prices. They say, for instance, there is a great water power at Niagara Falls; they may use that at night, and then for six or eight hours every day the power is idle; wherefore, if we can make the carbide of calcium during the day we can possibly make it very cheaply. As regards its competing with naphtha, you will see that if it is $5 or $10 per ton you can compare that with cannel coal at $10 per ton, from which you get about the same quantity of gas. Of course cannel coal will not enrich in proportion anything like what this substance would. As an enricher for water gas it has been a disappointment to all of us. With 10 per cent. of acetylene in water gas the gas burns blue; 20 per cent. gives you a little better light, while 40 per cent. gives you a beautiful light. There you see that it is of no use.

Mr. Addicks—How about the rise in temperature in sealed vessels? What effect would it have?

Dr. Wilkinson—It would simply give off gas if it came in contact with moisture.

Mr. Addicks—Then a rise in temperature would have no effect upon the sealed vessels?

Dr. Wilkinson—No.

Mr. Shelton—One of the most interesting facts I have ever encountered is the toughness of water gas and its lack of affinity for outside materials. But, joking aside, I would like to ask if Dr. Wilkinson can give any reason for this lack of effect of the calcium carbide upon water gas.

Dr. Wilkinson—I have thought of that a great deal, and was very much disappointed in the result. The water gas being made up largely of hydrogen and carbonic oxide, and both gases burning very free, taking on oxygen quickly, this gas will burn so rapidly that the carbon does not have a chance to stop and glow at a red or white heat, but burns like a bunsen flame. It is a substance which is itself just on the point of decomposition, so that when it comes in contact with air it burns very quickly. By holding the carbon back you can heat it to a glowing white heat.

The President—We are all under very great obligations to Dr. Wilkinson for giving us so much information on a subject that is practically new; and I would like to have you join with me in moving him a hearty vote of thanks. (Carried.)

THE QUESTION BOX.

The President—We will now take up the Question Box, and the Secretary will read the questions.

The Secretary—Question No. 1 is—

"What is the average amount of gas burned per annum by a gas range, and how much has the introduction of gas stoves increased the output of gas?"

Mr. Fowler—I have here a list of 10 cases, and another of 11 cases, where we put in gas ranges last year, none having been used the year before. In a list of 11 consumers the bills are dated from the 20th of June to the 20th of December in each year. In the year 1894 the increase for the 11 consumers for the six months was 52,300 feet. On the list of 10 consumers, whose bills are from the 20th of May to the 20th of November, the increase of the whole 10 was 87,200 feet. In one case I have for the whole six months an increase of 1,453 feet on the average, and in the other case, for the whole six months an increase of 792. I cannot tell how much of that went to the gas ranges, or how much was the natural increase for light. I believe that when a range is once in a house the people begin to prefer to use gas, and use it more freely than when they have not got a range. The average output for the whole 21 consumers for six months showed an increase of 1,102 feet. To my mind the prominent point in connection with the gas range industry is brought out in the few memoranda which I will now read—I have taken the average for the years 1883 and 1884: The summer consumption for June, July and August, according to the output at the works, was to the winter consumption as 100 is to 244. That is, the consumption for the three summer months was about two-fifths the consumption of the three winter months. In 1893 and 1894 it was as 100 to 191. That is, there was a little more than half the consumption of the three winter months. The total output has increased in the 10 years a little more than 60 per cent., but the summer output has increased 100 per cent. We have increased nearly as much in summer as in winter in actual output. Our summer increase was 73 per cent. of our winter increase. In other words, the steady load of the Company has increased, and we are working on a higher basis of output.

The President—I think Mr. Quinn can give us some information in this line.

Mr. Quinn—I have used a good many gas stoves, but have no figures as to consumers' meters.

The President—What is your judgment as to the consumption per month to be obtained from gas stoves?

Mr. Quinn—For many years we have put out gas stoves at Newport, and I have found that the average consumption was about 3,000 feet per stove per month, for a range of two or three burners.

Mr. Page—I am very much interested in the gas stove business. Since last May I have used in my kitchen nothing but gas for cooking purposes. I had a meter set specially to determine the amount of gas which was consumed by the gas stove and range. The range is a No. 301 Jewel, with water back. I have a few figures gathered hastily before coming here. I find that in 185 days, which would be just about half the year, we used 12,300 feet. That was the gas consumed for doing the cooking and part of the washing and ironing. We light up the water heater at any time we desire warm water for any purpose. This would be at the rate of about 25,000 feet per year. As I figure it out, it cost me about 12 cents per day for my fuel. As to the increase in the use of gas stoves in our city, of course we cannot tell exactly, because years ago we put out a great many of the old retort stoves which were being manufactured in Providence—they are scattered promiscuously about the city, and we have no correct record of them, so we are unable to tell how many of these stoves are in use. We have also in the last few years been putting in numerous small stoves. Last year we went into the stove business a little more earnestly, and I presume we put out 25 Jewel ranges of different sizes. Mr. Coggeshall and I, in figuring it over, thought the increased output from the use of stoves must be somewhere about 100,000 feet for the year. The price of gas in our city is $2, but if bills are paid before the 20th of the month, we make a discount of 10 per cent. We make no difference in the price to users of gas stoves at the present time. We did formerly make a discount, but since reducing the price all round, we make no change at present for stoves.

Mr. Holmes—I have a gas stove in my own house, which has three burners on the top, and a broiler and baking arrangement. For the three summer months I used it almost exclusively—perhaps starting up the coal range once a week, or once in two weeks, for washing purposes; and we consumed about 3,000 feet per month for both the gas stove and for lighting—using the same meter. We used on an average three burners of 5 feet each during the evening, sometimes until 10 or 11 o'clock.

The President—Then you probably used 1,500 or 2,000 feet per month for the cooking stove?

Mr. Holmes—I should say probably 2,000 feet.

Mr. Coffin—We made quite a push with gas stoves for the last seven or eight years. We have about 600 domestic consumers and about 300 stoves and ranges. We were often asked the question what it cost to run them. We do not set separate meters in any of the houses, but I did in my own, and found that we burned a little more than 2,000 feet

per month for the summer months when we used gas for cooking, and our washing and ironing were done at home. We had a 2-hole boiler stove set up in the laundry and used it for heating the ordinary wash boiler. We found it cost us from 8 to 10 cents for the washing, using the stove during a period of 3 or 4 hours. The cost of the stove at my house, with a family of six, and doing all the work except heating the bathroom water, was about $3.50 per month with gas at $1.50 per 1,000. We also have five or six consumers who use gas for cooking the year round, and they average from $2 to $3 per month. Most of them have somewhat smaller families than mine—families of three or four. So that we do not hesitate to tell people that it costs to use a gas stove from $2 to $4 per month, according to the size of the family and the manner in which the apparatus is used. I think 2,000 feet per month will run a house nicely, excepting for the bathroom.

Mr. Gifford—Some time since I looked up the record of about 75 gas ranges and found the average increased consumption in the houses where they were placed to be about 1,000 cubic feet more for the three summer months.

Mr. Hassett—In Beverly, where we have a separate price for gas used in stoves, we have 117 gas stove consumers. We set a separate meter. For the year 1891 the average consumption, from stoves, was 6,100 feet; for the year 1892, 6,900 feet; for the year 1893, 6,400 feet; for the year 1894, 6,300 feet.

The President—That is just the information we want, and I am very glad this discussion has brought it out. I would like to ask Mr. Hassett if any considerable number of those were used during the winter months, or is this consumption practically in the summer time?

Mr. Hassett—The consumption during the winter months (from October 1st to April 1st) in our stores is about 40 per cent. of the consumption from April 1st to July 1st.

The President—I understand you to say that this result is obtained from stoves with separate meters?

Mr. Hassett—Yes.

The President—And the consumption you have given is the average consumption in the use of 117 stoves?

Mr. Hassett—In the first year (1891) there were 49 stoves; in 1892, 64 stoves; in 1893, 105 stoves; in 1894, 117 stoves. It has increased our consumption in the last two years about 10 per cent.

Mr. Jenks—We have four consumers on our books who use gas exclusively for cooking, both winter and summer. The families vary in size from two to six members. My family happens to be the largest. My gas bill, month in and month out, averages 3,000 feet for the stove. No washing or ironing is done at home. The heating of the bath water, and all the rest of the work of the house, is done on the gas stove. The average amount of gas used is about 1,500 feet per month, and the price of gas is $1.60 per 1,000.

Mr. Fowler—I would like to ask Mr. Hassett whether all his stoves are connected with separate meters.

Mr. Hassett—Yes, until this year. Our net price now is the same for all purposes, and we are taking out our meters for stove use.

Mr. Coffin—I would like to add that from the best estimate we are able to make, taking the stoves that were set for cooking, one of which is in my own house, it seemed to us that in the last eight years we had created a business that in the three or four summer months was more in amount than our gross business was eight or ten years ago in those same months. We have really developed a new business with our cooking stoves.

Mr. Sherman—Mr. President: We would like to have something from your own experience.

The President—I cannot give it in detail, as I have no separate meters. Will you allow me to call your attention to the fact that Mr. Hassett, of Beverly, in a small town, had 49 stoves, in 1891, and sold through them 298,000 feet, while in 1894 he has 117 stoves, and is sending out 737,000 feet. The additional consumption that he has obtained in this way must make a handsome addition to his profits. Please give your attention while the Secretary reads the next question:

No. 2. "Does the use of oil as an enricher shorten the life of retorts—*i. e.*, as used in cartridges?"

The President—I think Mr. Fowler, who has had a long experience with cartridges, can answer that question.

Mr. Fowler—Our experience has been quite large in the use of cartridges, but we are unable to see that the life of the retort is shortened. We do believe, however, that we are obliged to burn out oftener than we should if we did not use oil in that manner—that is, if we used it in some way to get a more complete carbonization. That, of course, has a slight influence on the life of a retort.

Mr. Coffin—We thought when we first started in that we had very nice results. Whether we got to the point of expecting more than that which satisfied us two or three years ago, or whether there was some difference in the oil, I cannot say; but our results were not quite as satisfactory last year as they had been before. It is my opinion that it does affect the life of a retort. Our yield has been about the same from 1889 up to the 1st of January, and our average make for six years has been from 4.96 to 5.05 to the pound. We do not allow any value for the oil. We merely charge it as an enricher. Our method of running is not materially changed. We have run as high heats as we could get in all that time. I think, if what the makers say of the retorts and settings is true, they are not only as good, but in most cases better, and that the oil is responsible for the shortening of the life of our retorts.

No. 3. "Is there any economy in using thick-sided retorts, and why?"

The President—If the gentleman who asked the question is willing to announce himself, he can probably explain the question more fully.

Mr. Cooper—I am the one who asked the question, and for this reason: We had some retorts set at Exeter, on the lower ones of which we used the shield tile. I was sent for one night by the man at the retort house, who reported that part of one of the retorts was in the firebox. I went over and found that some of the shield or protecting tiles had broken off and fallen into the firebox—this was after two weeks' running. Upon inquiry I found that there were some gentlemen present who had used thick-sided retorts to obviate this difficulty, and hoped to learn something from their experience. Perhaps I did not put the question just right, but that is what I meant—is there any economy in using thick-sided retorts instead of using the shield tiles?

Mr. Neal—I am using those retorts and I like them very much. They dispense with the shield, which was always breaking and giving away. I cannot state how long the retorts will last, but since I have used them I like their working very much.

Mr. Coffin—This matter was called to my attention a year ago by Mr. Learned, and as we were building some new arches and settings in four benches of 6's, I tried to change from the old-fashioned retorts, and found that Waldo Bros. were willing to accommodate us and to have the experiment tried. They changed one bench, so that in three benches I took two thick-sided retorts, putting them on the bottom, and, we think, with very good results. We have worn out the bench we had of shield tiles. They came down into the furnace and were thrown out. We let that bench down, lined up the fire hole and put in new shield tiles on each side, but they came down the same way as the others. We have two benches now, one of which has been running for a year and the other for 14 months. The three that were set with thick-sided retorts are intact to-day; and they are the best retorts in the bench in both instances.

Mr. Cooper—Has the bench been in continual use, or has it been let down and then started up again?

Mr. Coffin—The bench that is about 14 months old was started up a year ago last January. The others ran through last winter, and were let down during the summer, and ran about six months this winter, with the other put on in January, 1894. So that we have a sample of each. I think they heat better. I do not think that the thickness added to the retort was quite as heavy as the tile would be in addition to the retort. We have had trouble with the angle tile coming down to the furnace. We have had them do it right along.

Mr. Lamson—How much is the retort thickened?

Mr. Coffin—I think it is from 5 to 6 inches. I think our angles, as I remember them, were about the thickness of two courses of brick. Under the retort the angle tile must have been about 8 inches, and on the side from 6 to 7 inches. I think the retort is from 1 to 1¼ inches thinner. It looks to me as if we could safely put in the old style of retort in the middle and top of the same arch, and go through again. The bottom retorts are all right.

No. 4. "Does the fact that one gas has a higher candle power, or, theoretically, more heat units than another, necessarily prove that it is of more value when used in a bunsen burner, as commonly applied to gas stoves?"

The President—Can Dr. Wilkinson answer that question?

Dr. Wilkinson—As I understand the question it is: Would gas of a greater number of heat units, or gas of a less number of heat units, have the same or greater effect in one case or in the other? I think the greater number of heat units would tell. The bunsen burner is a prime burner and does not smoke or waste the gas. If we compare gases of the same make, the higher the candle power the higher the heat. If we

compare coal gas of 16-candle power with water gas of 30-candle power, we will find them nearly equal in heat giving qualities.

Mr. Gifford—I have the results of a series of experiments, in which a given quantity of water was heated, from 62° F. to 112° F., by several different gases, among which were coal gas, carbureted water gas, fuel gas, etc. Care was taken to have the conditions as nearly alike in each case as possible. The total heat calculated from the analyses varied almost exactly as the volume of gas required, thus showing that the work done follows the theoretical value, and that for purposes of comparing one gas with another the calculated heat can be relied on, while the illuminating qualities depend on the way in which those atoms are combined. We just had the question of acetylene before us. Now acetylene has very high candle power. Its molecular formula is C_2H_2. Now, if you add four atoms of hydrogen to the molecule, you make it C_2H_6—ethane. The candle power of ethane is perhaps one-fourth that of acetylene, but the heat given off by the burning of one foot of ethane is considerably greater than the heat given off by the burning of one foot of acetylene. One gives very much greater candle power, while the other gives greater heating power.

No. 5. "Is there any practical method of determining the heat units in a Bunsen flame by boiling water over it? What is the formula for working out the problem?"

The President—Mr. Gifford, you have almost answered the question. Will you go a little further with your statement?

Mr. Gifford—I should say it would depend entirely upon how much heat you wasted.

The President—The question is, Is there any practical method of determining it?

Mr. Gifford—I do not know of any except with the calorimeter.

The President—Can Mr. Hinman answer it?

Mr. Hinman—I think Mr. Gifford has answered the question.

Mr. Addicks—I want to say that the same gas burned through different burners gives very different results; and one should be very cautious as to the results that he gets in that way.

No. 6. "In view of the extreme and prolonged cold of the present winter, what has been the effect of cold upon the transportation and storage of petroleum and distillates used as enrichers?"

Mr. Lamson—I should say there had been no effect. It comes in first-rate shape, and a little more than holds out, so far as we are concerned.

Mr. Addicks—I do not think that is the idea the question intended to convey. I think it relates to the difficulty in handling.

Mr. Lamson—I thought it asked whether it condensed so that there was less in bulk or value.

Mr. Addicks—It is a question of the precipitation of water from freezing.

Mr. Lamson—I have somewhere in my bag or pocket a letter and telegram just received from the Standard Oil Company which say the Company will not be able to get any naphtha to me for ten days. That means the barges are frozen up in the harbor.

Mr. Addicks—I think if the gentleman who asked the question will disclose himself and tell the trouble he has had, possibly other members may think of some troubles they have had during the winter.

Mr. McKay—The oil we have been receiving has sometimes stood for several days on a railroad siding exposed to very low temperature and very high wind, and our experience has been that low temperature hastens the precipitation and separation of the water held mechanically in the oil, and of course causes a solidification of the water and prevents the unloading of the car. I would like to know whether anyone else has had any such experience, and, if so, what means they have taken to clear the ice from the bottom of the car in order to get at the oil above it. We have often had it happen that the oil would start running, and then the low temperature would cause the water to freeze in the hose connection between the car and the pipe line. Then we could neither disconnect the hose from the car, nor unload the oil. I would like to know if anyone has had success in getting rid of such ice.

The President—Does this question apply to crude oil, and not to naphtha?

Mr. McKay—This was the distillate. The best we could do was to heat gas oil in barrels to a temperature of about 250°. We then transported it immediately to the car (distant about 1½ miles), and by the time it reached there it had a temperature of about 180°. The hot oil was poured in through a funnel attached to a pipe passed through the top of the car, so that the oil ran down to the bottom of the car, melted the ice, and cleared out the hose. But that is only a makeshift arrangement for that one case.

Mr. Addicks—I think Mr. McKay did very well to get out of the trouble in the way he did.

Mr. Fowler—We have had some trouble by the pipe filling up between our retort house and the oil well. The trouble came repeatedly—two or three times a week. We got over it by leaving the pipe and using cannel coal.

The President—Has any other member had trouble this winter in discharging cars of oil; if not, we have now reached the end of the question box. Has any gentleman any business that he wishes to bring forward?

Mr. Addicks—I will take but a moment's time in suggesting the possibility, in view of the difficulty the Secretary has in securing papers, that if members would signify the subjects they are interested in, in all probability the members would be more ready to write on the subjects they know about than they seem to be at present. I think it would be well if the Secretary would ask from each member an expression of his personal wishes as to subjects he is interested in; and I think it would help somewhat in securing papers.

The President—Acting on Mr. Addicks' suggestion, I will ask if there is any subject any member would like to have discussed at the meeting a year from this time. I think, however, that can be safely left in the hands of the able officers who are to manage the Association from this time on. Is there any further business?

VOTES OF THANKS.

Mr. Lamson—I feel that, before we separate, I ought to offer a resolution of thanks to our President for the able manner in which he has conducted this meeting; and on that resolution I would like to say a word. We have had a most pleasant meeting, and I do not doubt it has come to your minds, as it has to mine, how noticeable is the difference between this meeting of the New England Association and the meeting of the American Association. I have been exceedingly gratified to see how many of our members have been present, packing this room all the time, listening to the papers and taking part in the discussion. I feel that we have had a most satisfactory meeting, and I think you will all go home much gratified. I therefore move a vote of thanks to the President for the very able manner in which he has conducted the present meeting; and I ask the Secretary to be kind enough to put the question.

Mr. Fowler—I take very great pleasure in seconding the motion.

The Secretary—You have heard the motion—that a vote of thanks be extended to the President for the able manner in which he has conducted the meeting. All in favor of that motion will signify it by rising. It is a unanimous vote. Mr. President, you have the thanks of the Association.

Mr. Lamson—If I may be allowed, I desire to offer a second resolution. I think we all want to express our thanks to the Secretary for his work. I must say I have never fully understood what it meant to be the Secretary of this Association until I saw the work of Mr. Prichard during the past month; and I hope that when the President puts the motion for a vote of thanks to the Secretary you will all rise and give it your very hearty support.

The President—It gives me a great deal of pleasure to put this motion. I know very well how hard the Secretary has worked to make this meeting a success. Those in favor of the resolution offered by Mr. Lamson will rise. Mr. Prichard, you have the thanks of the Association, and you deserve it. If there is no further business, I now declare the meeting adjourned.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—CONCLUDED FROM PAGE 298.]

PROCEEDINGS SECOND ANNUAL MEETING OF THE MICHIGAN GAS ASSOCIATION.

HELD AT THE HOTEL VINCENT, SAGINAW, MICH., FEBRUARY 20.

MORNING SESSION.

President Sedgwick Dean then read the following

PRESIDENT'S ADDRESS.

Mr. Secretary and Gentlemen: The pleasant smiles, the hearty greetings and the personal interest manifested in each other by those who were present at former meetings of our Association demonstrate that, even if this Gas Association has not materially advanced our technical knowledge of the gas business, it has at least taught us to appreciate each other. This conquering of selfishness, the foundation of all indifference and reserve, is highly gratifying to the organizers of this Association. Well-wishers of our business will bid this spirit God

speed. Association begets confidence; confidence, friendship. Though silent and unobserved, this growth of fraternal friendship will soon reach a point where all of us will discover that many of those whom we most highly prize as friends and associates were first met at one of these pleasant yearly meetings. When this consummation is reached, our gatherings will not only be meetings of brothers in business but brothers in motives in which each values his fellow's welfare as highly as his own.

The remarkable 1894, with its great business depression, enormous shrinkage in values, and accompanying train of financial disasters, is in the past. Our business, in common with all others, while suffering from this deplorable condition of affairs, has, as a whole, made some progress. This apparent paradox is explained by the fact that the state of business compelled economy. Gas being for its cost relatively the best light, we have gained our competitors' losses; this, with the great increase in incandescent lighting and the use of gas for fuel, has more than covered the shrinkage incident to hard times, and has made the total show for the year an increased output.

The outlook for increased sale of gas is bright, but for the maintenance of present dividends is somber. Numbers of conditions indicate that the future will prove the correctness of these views.

First—There is what good judges deem a permanent advance of 1 cent per gallon in the price of refined carbon oil. One cent seemingly is a small amount, still it is 30 per cent. advance to the refiner and 25 per cent. to the consumer. Assuming that the lamps used for lighting stores, factories, etc., consume an average of one-half gallon each night, this change in price means an increased cost of over $1.50 per year for each lamp. This statement applies to consumers who buy oil at wholesale. Those buying at retail will have to pay a farther advance of from 20 to 30 per cent., which brings the cost of lighting with oil to a price where the Welsbach burner is an active competitor, giving at the same cost as much light, which is of a far superior quality to that from oil, and at the same time doing away with the odor, smoke, heat and care of lamp.

Second—Gas companies have universally increased the illuminating power of their gas, and a large majority have, in addition, reduced the selling price.

Third—The Welsbach burner, though hampered in its sale by many unbusinesslike restrictions, has nevertheless placed gas companies in a position to furnish a class of consumers with a much stronger and cheaper incandescent light than the electric, without sacrificing any of its essential qualities.

Fourth—All classes of the community are becoming educated in the use of gas both for cooking and for heating apartments. The increase of consumption in this direction has far exceeded the predictions of the most sanguine, yet each succeeding season develops an increasing demand. This fact, with the one that the largest and best equipped stove works are now turning their attention to the manufacture of gas ranges and heaters, indicates that the reduction in the price of gas appliances which this new competition is sure to bring will still further increase the use of gas for fuel.

The drift of prices for the past 35 years has, with slight exception, been steadily downward. Sauerbeck's tables show that the price of articles covering 80 per cent. of the value of marketed commodities has within that period declined 31 per cent. The price of gas has not been an exception to the general tendency. Thus far the greater part of its decline has been met by the economies of improved methods and increased output. However, it is hardly necessary to say that the gain from enlarged sales, when gas is sold from 80 to 90 cents per 1,000, must be viewed from a different standpoint than when the price was from $2 to $3 per 1,000. In fact, does not this query present itself: Are not the two means of relief just referred to practically exhausted? Then, to what new source may we look to meet and satisfy the ever present demand for cheaper gas? There are but three things to prune—namely, cost of material, wages of employees, and dividends of stockholders. Which of these three, think you, is likely to suffer first?

From the outcry against the socialistic tendency of the American people, as developed in their treatment of corporate interests in general, it is evident that a growing class of our people is seeking, under the plea of a more equitable distribution of the results of labor, to transfer the property of corporations to State administration and ownership. It must also be admitted that this movement is by no means confined to the ignorant and vicious. It occasionally crops out in the collegian and the minister, and there are isolated cases where statesmen in Congress have shown tendencies in the same direction. How can this desire to prostitute forms of law to accomplish the ends of the highwayman be checked? To my mind the answer is simple. Let managers of gas companies and all other corporations rise to a plane of honesty which limits stock certificates to actual paid up capital and dividends to a fair rate of interest on such capitalization. When this is done they will have removed a beam from their own eyes, which will enable them to see that stock jobbing, which issues certificates of stock on earning capacity, whether done by a board of directors or in the name of a syndicate of capitalists, is robbery, committed at the instigation of the same dishonest motive which they so bitterly decry in the class first mentioned.

The proceedings of the 28th annual meeting of the National Board of Underwriters contains much information of importance to the general public and of especial interest to the gas industry. The fire loss of 1893 was nearly 60 per cent. of the premium received, amounting to $90,334,070, being an increase of 12 per cent. over 1892.

President Skelton, in his address, says: "Concurrent action regarding our present greatest enemy—electricity—seems to be imperatively demanded. There has been plenty of evidence, during the past 90 days, that fires caused by electricity are growing alarmingly frequent, and inspections show that but few buildings in any community are safely wired. This great and increasing danger cannot be ignored. It threatens the very life of fire insurance. Appendix 'A.' of the proceedings gives a detailed statement of 241 fires occurring between the dates Jan. 10th and April 10th, 1894, which were known to have been due to electricity; 186 of these were extinguished with slight or no loss, the remaining 55 entailed a loss of $1,271,631. Assuming that this amount fairly represents the proportional loss, then that for a year would be $5,086,524, being 5½ per cent. of the entire loss for 1893, and 54½ per cent. increase of loss over the previous year, chargeable to what?"

In President Skelton's terms—"our greatest enemy"—this statement includes only fires known to be due to electricity. How many millions should be added for those coming under the heading, "Cause unknown," can only be conjectured.

The vigorous words of President Skelton and the amount of money involved seemingly would have justified radical and prompt action. The underwriters, however, maintained their reputation for conservatism, without regard to consequences, by the adoption of 184 rules governing the wiring of buildings and the use of electricity for heat, light and power, suggested that municipal ordinances be passed for the inspection of buildings, to ascertain if their rules had been complied with, and instructed the executive committee to formulate a rider for policies, prohibiting the use of electricity for any purpose until consent for such use had been indorsed upon the policy.

Among the rules reported may be found the following: "Wiring must not be laid in plastering, cement nor similar finish; must never be fastened with staples; must be protected when passing through floors, walls, partitions, timbers, etc., by waterproof, noncombustible insulating tubes, such as glass and porcelain. Flexible cord must not be used in show windows."

An analysis of the proceedings justifies the following conclusions:

(*a*) That the number and extent of loss from fires, known to have originated from the electric current, will compel insurance companies to advance their rates upon wired buildings, unless some safer way of wiring than that now in common use can be found.

(*b*) That the rules adopted for wiring are an effort to obtain that result, notwithstanding that the discussion had, at their adoption, revealed the fact that no speaker advocating them was willing to say that a faithful compliance with them would be a positive guarantee against electric fires, but only that they promised the best relief that present experience suggested.

(*c*) That the enforcement of these rules by the insurance companies would require an army of inspectors, which would entail a ruinous expense upon the fire insurance business, to avoid which an appeal to municipal regulations was made, thereby adopting the populistic plan of asking the community to do something to make your business profitable and thus permit the general public, including the consumers of gas and oil, to contribute, by taxation toward compelling landlords who use electric current to put and keep their wiring in such shape that their property can safely be insured at the lowest rates.

(*d*) That the claim made by electric light solicitors that the danger from fire is less when lighting with electricity than with gas is untrue. That the facts given in the report demonstrate the exact opposite to be the truth.

(*e*) That the insuring of buildings so wired, as 99 per cent. of those now using the electric current are wired, at an even rate for unwired buildings, is a discrimination against other insurees who are charged an equal rate on less hazardous risks.

(*f*) That in the event of a safer mode of wiring being found which compels rewiring or the discontinuance of the present discrimination in

insurance in favor of electric current, the result must be beneficial to the gas business.

The charter membership of our Association is broken. Hon. Thomas D. Gilbert, who honored us by accepting the Vice-Presidency of this Association, has gone to the new life which is only entered by the gateway of death. As deeds are more eloquent than words, so his life record outshines beautiful references to his memory. Broad minded, patriotic, true to every trust confided to him, he lived a long and useful life, worthy of the respect and admiration of all who knew him; and, leaving the world better for his having lived, died, the noblest work of God—an honest man.

Finally, let the membership of this Association remember that its strength is not necessarily measured by its numbers, but that its ability must be judged by what it accomplishes; that what is sown here should be gathered in the various communities you serve. Let the gas you sell, the manner you transact your business, and your eagerness to bring to public use every improved method, attest that you are a member of an Association anxious to forward the best interests of all.

Reading the Papers.

The first paper read was that of Mr. Joseph Walker, of Port Huron, entitled "Opposition Gas Companies." After a long discussion and much good advice by the President on the subject, a vote of thanks was tendered Mr. Walker for his paper.

Mr. C. H. Raynor then read his paper on

FEDERATION.

Mr. President and Gentlemen: In presenting the subject of federation to you I do not assume either subject or train of thought to be new or original. At the last October meeting of the American Gas Light Association the matter of federation was, to my mind, ruthlessly "sat down upon." The mere fact that due consideration and proper knowledge of the detail of such a plan were lacking at that meeting, forms one of the most cogent reasons why, though stricken down, like "Banquo's ghost" it should rise again. I quote from a gas magazine: "Discussion bearing upon this subject at that meeting was not untrammeled, and the true reason of the defeat of the measure was, that being deprived of the opportunity for a proper understanding of the subject, members chose to vote against what might prove a good measure, rather than to vote for what might prove a bad one."

This to me seems a fair summing up of the discussion at that time. I quote from the American Gas Light Journal, Nov. 12: "Due invitation was extended to various Associations, Michigan among the number, to meet the Committee on Federation, at Cleveland, in May last." No response was made by Michigan to the invitation, hence I venture at this, our following meeting, to present the subject that it may have a fair discussion, and we may as an Association at least declare ourselves for or against federation.

Federation may be defined as a joining together of different leagues, societies or forces for the purpose of greater strength, which comes, or should come from the union of numbers working together in harmony more than from the individual efforts of the same, even if directed apparently in the same channels. Hence, where mutual interests are to be manipulated, organization of some sort becomes a necessity for their advancement.

Just in proportion as their common interests spread over a large territory, so must the method of organization be broadened.

We have at present certain organizations of our gas men, or interests, so to speak, but, if I may be allowed to criticise, not organized in just the best way to accomplish the greatest good for all.

We have some State Associations, many large ones, prominent among which are the American and Western Associations. Of three of these specified I have the honor to be a member; a fact I state that you may know I speak from an unprejudiced standpoint.

Now, if instead of a number of territorial Associations, so to speak, there was but one, a national one, made up of representations from the State organizations (and where such did not exist, members representing their several companies), meeting annually or bi-annually, as might seem best, would there not be a decided improvement in results over those now attained by the numerous separate organizations?

These are some of the advantages that should arise from the federation meetings:

An enlargement of acquaintances by bringing scientific minds working in the same channels into personal relationship for a comparison of methods, an opportunity for exchange of the better for the best, acquiring ideas, a stimulus to renewed activity in inventive methods, a lifting from the old rut, a broader circle to traverse and the welding together of the conservative Eastern mind with the progressiveness of the Central and the push and aggressiveness of the Western. Naturally the representatives at the national meeting would be the brightest, most progressive and cleverest thinkers of your State Associations.

Every section of our large land would be represented, the effect of which should be the gathering of the best results of experience as gained from the experimenting with and the working out of problems by a united body of thinking, practical men, bound together in one common brotherhood, identical in interests and needs, and not divided into factions caused by sectional limitations.

In such a federation let there be recognition of mutual kinship of all, of whatever opinion. Let each be entitled to consideration and respect, equal sharers of the common gifts; each one bringing his knowledge and special talent for the common good; all being enriched by friendly participation in such mutual fellowship and experience.

The tendency of narrow ideas is to run to routine. We all, Association as well as individuals, need mutual comparison and counsel, to extend our knowledge of what others are doing, to increase our own ability, and add our mite to the general fund.

Many questions might fitly come before a National body which very naturally would be too broad in character to be discussed before a smaller Association. For instance, a record of activities or progress in various countries of the globe; contrasts of methods of work, foreign and native; and investigation of causes which bring about certain results. I will not continue this thought, but will rest satisfied if I have succeeded in bringing to a fair and open discussion a topic that seems to me well worthy of serious and careful consideration.

After a somewhat animated discussion of the subject of this paper, a vote of thanks was given to Mr. Raynor and this resolution offered:

Resolved, That this Association favors Federation of Gas Associations as proposed by the Council on Federation at the 22d Annual Meeting of the American Gas Light Association.

This question, being of a special nature, was decided by ballot, the Secretary acting as inspector, and resulted as follows: Ayes, 2; nays, 16.

Committee on President's Address.

On motion of Mr. Douglas that the Secretary name a Committee on President's Address, Mr. Douglas, Mr. Eaton and Mr. Knight were constituted such a Committee.

The meeting here adjourned until the afternoon.

Immediately after dinner the members of the Association met at the office of the Gas Company, and, boarding a private motor car, went to the works of the Company, where an hour was spent in looking over the plant.

Afternoon Session.

The afternoon session was called to order at 4 o'clock, and Mr. Eaton read his paper on

WHOSE MAKE OF LIGHTING FIXTURES SHALL WE RECOMMEND?

Do you think I am about to bring to your notice some maker of this line of goods and ask that your influence and patronage be extended to him? Far from it, for none are known who are worthy.

The greater number of fixtures for gas that are on the market are made with the aim of having something symmetrical and beautiful, with utility as a second consideration.

How many securing a new customer, after a tussle with our electric friend, and the prejudice of the prospective customer in favor of some reading lamp he may have been using, have had him complain of "the poor gas you are giving us," and, on investigation, have found rooms, with ceilings 9 feet high or under, with fixture of proper length hung from center, but have also found the arms of the fixture curved so much that the light was at least 7 feet 2 or 4 inches from the floor, and the gas flame encased in a so-called glass globe which, if it had a hole in the side to set the "bull's eye," could be used as a case or jacket for a dark lantern.

We all know the remedy; rooms with ceilings 9 feet and under need fixtures with arms nearly if not quite at right angles with the bottom of fixture, and glass with as little etching as the customer will accept; or, better, with no globes but candles.

The fixtures that should cause us as gas men the most concern are the combination fixtures that have been and are daily being put on the market. In 95 per cent. of them gas is given a secondary position on the chandelier, and in an equal portion of fixtures above two lights the pipe used is too small to give good results; but the manufacturer of the goods is not entirely to blame.

The demand for combination fixtures came with electric lights. From whom? Not the gas companies, but from the makers of electric illumination. The demand on the manufacturer first coming from them, the goods were, as a natural consequence, constructed to please that trade, and, in giving their suggestions to the fixture makers, our friends did what all men would have done under the circumstances—secured fixtures that gave the electric light a position on the chandelier that would be a great advantage over gas; and as over 90 per cent. of the demand for combination goods has come from directions dominated by that same influence, all fixture makers have catered to the demand made on them, with the result that you can scarcely find a combination fixture that is not constructed on the lines indicated. In fact, they are made with a view of forcing the use of electricity a greater portion of the time, and gas only when the "light of the future," so-called, fails from some of the many causes that prevent it being as reliable an illuminant as gas.

To establish the assertion that the makers of electric current and electlighting apparatus have influenced the construction of the combination goods now offered to the public, it is only necessary to note, at nearly every meeting of any association of electric companies can be found representatives of prominent fixture manufacturers; on the other hand, notice the almost entire absence of fixture men from gatherings of gas people.

Contrast with this the attendance at Gas Association meetings by the manufacturers of gas stoves and ranges. Why do they come? Simply because they rightly look for the major portion of their trade from the gas companies and their trade connections. Their first best business interest is our second best one, and should be recognized as such.

In cities and towns where the gas companies have sold direct, gas stoves and the proportion of residences having in use cooking and heating and hot water appliances are greater, and the quality of apparatus better, than in those towns where the gas companies have not organized a stove department, but have allowed the dealers to supply the demand.

The same conditions exist when fixtures are substituted in the comparison for stoves. In a majority of cases the prospective purchaser of fixtures looks only to the appearance and gives no special thought, until it is hung in place, how the light will be distributed in the room, and the salesman, not being concerned beyond making a sale in as easy manner as possible, finds what pleases the fancy of the customer, and sells it. Whereas, if a representative of the gas company was making the sale, he would or should consider the use of and the results to be obtained from the article sold, and, if he were a good salesman, those that would do the best for gas.

While we should try for all the gas consumption we can get by the gas range and kindred appliances, we should not let the gain in volume from that direction allow us to overlook any loss to the lighting branch of the business. We must not forget that our trade is a lighting one and that *gas light is the best*. Nineteen companies in this State last year reported 20 per cent. of their product sold for fuel purposes; let us not neglect the 80 per cent.

If the gas companies will establish a fixture department as well as stove branches of our business, or control a fixture business, we will soon attract the attention of the fixture manufacturers to our needs, and we must demand of them a line of goods in gas only that have the light as low to the floor as practical, and in all grades of combination goods a construction that will place both gas and electricity on an equal footing.

Every factory has in its employ one or more designers, many of whom are artists, and when the manufacturer finds the demand is on him for this class of goods he will produce them, but we must not ask that they be made and expect the venders of electricity to recommend or sell them; for, with both lights placed equal on the fixture, the percentage of the lighting bill they would obtain from combination fixtures would be small.

We should sell them, and educate our trade, who want combination goods, to demand such as will give them an opportunity to use either gas or electricity on an equality, so far as the positions of the lights on the fixture are concerned. We can well afford to chance getting the lion's share of the business from combination fixtures under these conditions.

When a manufacturer does bring out a line of fixtures to meet this need, let the gas people lay aside their conservativeness, recommend the line and sell the goods, and in a short time all will be looking to produce goods that can be sold gas companies and their connections in trade. I speak more in reference to combination than in gas fixtures, for if a consumer is to use gas under all circumstances, we can find something from known makes that will supply him; but combination fixtures must be constructed differently, or gas will not be used in buildings fitted with them in as great quantities as the volume of light given for the price warrants. As stated before, present method of construction is for the purpose of forcing the use of electricity. The getting of light consumers is one of educating them to want it; so let us see to it that our competitors, and the fixture makers, do not educate them away from us.

The paper called forth much comment on the present construction of combination fixtures; and, on motion, Mr. Eaton was given a vote of thanks for his paper.

Then followed the paper prepared by Mr. Henry W. Douglas, entitled:

THE HEATING EFFECT OF ARTIFICIAL LIGHTS.

Some of the first and strongest objections to the use of gas for illuminating relate to the great amount of heat which is given out and the vitiation of the atmosphere caused by such use. To determine the extent to which this was true, and to see whether one burner was better than another, the tests which are described in this paper were carried on.

It was found very difficult to find a room for making the tests where the radiation from the walls of the room was not excessive or could be easily computed. After beginning the experiments it was found that instead of the walls radiating the heat of the gas to the outside air, the walls contained a large amount of heat which they imparted to the air of the room during the test. This heat was such an uncertain factor that it was impossible to compute it, and the only way was either to make a test of long duration, so that the walls would take the same temperature as the air of the room, or to bring the tests under as nearly as possible similar conditions so that the results would be comparatively correct.

The room selected was 19 feet 3 inches by 9 feet 7 inches, and 7 feet high, and was surrounded on all sides by the external air. The walls were brick and 9 inches thick, and it contained one window with wooden shutters which were kept closed during the test.

In the series of experiments given in the table (in all but those of the albo-carbon and Lungren lamps) four lights were used, hung 2 feet 6 inches from the ceiling at the four corners of the room. Five thermometers were used in the room, one at each corner, about 4 feet from the lights, and one in the center of the room, except in the two cases mentioned, when, as the single lamp was hung in the center, that thermometer was necessarily omitted. All thermometers were carefully calibrated, and the average reading of the five is the result given in the table.

	Candle Power.	Consumed.	Mean Initial Temp.	Mean Final Temp.	Mean External Temp.	Amt. Raised.	Amt. Raised per Cubic Foot.	Amt. Raised per Candle Power.
Four 7-foot Bray burners.....	88.0	23.0	45.5	58.6	2.0	13.1	.570	.131
Four Welsbachs.	200.0	10.5	41.6	51.95	9.0	10.45	.685	.052
Four Argands...	91.0	22.8	50.8	60.8	26.0	10.2	.738	.265
One 6-light albo carbon.....	133.0	26.0	44.00	61.7	8.0	17.69	.664	1.333
Two Rochester oil lamps. ...	32.8	8¼ oz. .08 gal	46.4	59.4	22.0	13.0	.....	.396
One Lungren lamp..... ...	50.8	8.48	45.8	54.8	2.0	9.0	1.610	1.800

All sources of heat were shut off from the building some time previous to the tests, and the room was allowed to cool to about the temperature of the walls, so as to obviate as much as possible the radiation of the walls spoken of.

In test "A," four Bray union jet, 7-foot burners were used, without shades. The candle power given was not observed at the time, but was computed from the known candle power of the gas at the time. The results are almost what might be expected.

The Lungren lamp, with its large amount of heating surface, gave to the room the greatest heat per cubic foot of gas used, while there followed in order the Argand and Welsbach, having the next larger amounts of surface, and lastly the open flames of the albo-carbon and Bray.

As regards the heating power in relation to the illumination, the Welsbach is far in the lead with an average of only .052° rise of temperature per candle power. Following this in order are, Bray burner, .131°, Argand, .265°, Rochester oil lamp, .396°, Albo-carbon, 1.333°, and Lungren, 1.800°.

A second set of tests was made to determine the direct radiant heat of the lights. Thermometers were allowed to hang in a room a sufficient

time to register the exact temperature of the air, and were then removed to 8 inches of the light to be tested, and an observation made of the time required for the temperature to rise 4°. The room in which these tests were made was sufficiently large and well ventilated that the rise in temperature was due to the direct influence of the light alone, and the surrounding air was not affected.

The results were as follows:

Name of Burner.	Time Required.
7-ft. Bray	1 min. 43 sec.
Argand	2 " 35 "
Welsbach	3 " 6 "

The heating power being inversely proportional to the time required to produce this heat, the advantages of the different lights would be in the inverse order given in the table

The results of these experiments only go to give an additional merit to the Welsbach light. In proportion to the amount of gas used, the heating effect on the atmosphere is not at all excessive, and about as other lights in common use, while the results, in proportion to the illuminating power, are less than half of the best results on other forms of lights.

A series of tests, made by a commission appointed by the London *Lancet* (AMERICAN GAS LIGHT JOURNAL, Jan. 28), have proven the same thing, only in a more complete and valuable manner than it was possible for me with limited time and apparatus.

Further experiments have definitely proved that the contamination of the atmosphere with the Welsbach was not only less than any other light, but that, after a most severe test, there were not the slightest indications that the products were injurious to health, giving conclusive proofs of the falsity of the statements which have been going the rounds of the electrical press.

The consumption of oil, as shown in the test of the Rochester oil lamp, leads us to believe that in the future kerosene is not to be the light of the poor; as .4 of a gallon of oil, at 10 cents per gallon, costs nearly as much as the gas required for a Welsbach light, and gives only one-third of the illumination.

Respecting the Publication of the Proceedings.

After the discussion of Mr. Douglas' paper, and a vote of thanks to the author for the same, the following resolution was offered as an amendment to the report of the Executive Committee in regard to the publication of papers:

Resolved, That the papers read before this Association, at this meeting and at future meetings, until otherwise ordered by the Association, shall be furnished to the gas journals for publication, providing the author of any paper does not object to the publication of his paper. (Adopted.)

Place of Next Meeting.

The committee on place of holding next meeting reported that when the Association adjourn, it adjourn to meet in Jackson. (Adopted.)

Minute to the Memory of Mr. T. D. Gilbert.

The Committee on Resolutions made the following report:

Whereas, The members of this Association, on the 18th day of November, met with an irreparable loss in the death of our Vice-President, Thomas Dwight Gilbert; therefore,

Resolved, That the Michigan Gas Association desires to express its deep sense of sorrow in the loss of our member, and in some slight degree our appreciation of Mr. Gilbert's personal character and ability.

His earnest and unselfish qualities and labors have contributed much to the present standing of the gas industry in our State. Even at his advanced age, he felt as deep an interest in all that concerned our business as at any time since he first identified himself with it some 40 years ago.

He was a firm believer in the benefits and advantages of gas associations, and the formation of this, our Michigan Gas Association, met with his hearty approval and co-operation.

He was long known as a staunch advocate of low-priced gas and the broad policy of considering the interests of the gas customer and stockholder identical.

The business of the Company he managed was conducted strictly upon this line, and his reputation as a Manager of ability, integrity and sound business views reached beyond the border of our own State.

We realize, in the removal of our associate from this life, not only the loss of a member, but of a noble man, who, in all dealings with his fellowmen, proved himself actuated only by profound convictions of right and the purest and most unselfish of motives.

Resolved, That we here record our heartfelt sympathy with the relatives and near friends of the deceased, and that a copy of these resolutions be entered on the minutes of the Association, and a copy of the same be sent by the Secretary to the widow of the deceased.

Election of Officers.

Committee on Nominations made the following report:

Gentlemen—Your Committee, appointed on the selection of officers of this Association for the ensuing year, beg to submit the following report:

President—H. D. Walbridge, Grand Rapids.
Vice-President—W. M. Eaton, Jackson.
Secretary and Treasurer—Henry H. Hyde, Saginaw.

ROBERT CALHOUN, Chairman.
JOSEPH WALKER.
W. H. MORGANS.

Report of Committee on President's Address.

The Committee on President's Address made the following report:

Gentlemen—Your Committee on President's Address congratulates the Association on being the means of furnishing to the gas fraternity such an able review of the present condition of the gas industry, and recommends that the address be published in full with the proceedings of the Association. It also, in behalf of the Michigan Association, wishes to thank the retiring President for the manner in which he has conducted the proceedings of this Association.

H. W. DOUGLAS, Chairman.
W. M. EATON.
J. J. KNIGHT.

It was moved and carried that a vote of thanks be extended by the Association to the Secretary for the manner in which he performed the duties of his office, and for entertainment accorded the members while in Saginaw.

The following telegrams were received and the Secretary instructed to reply to them by letter: DETROIT, MICH., Feb. 20, 1895.

To Michigan Gas Association, Hotel Vincent: Prevented from attendance at your meeting by unexpected business. I express to you my best wishes for a successful meeting. GEO. OSIUS.

HOUSTON, TEXAS, Feb. 19, 1895.

To HENRY H. HYDE, Secretary Michigan Gas Association: Distance prevents my presence; best wishes for a successful meeting.

D. J. COLLINS.

There being no more business to come before the meeting the Association adjourned, to meet in Jackson, on Wednesday, Feb. 19, 1896.

A New Method of Measuring Illumination.

[Read by Messrs. Edwin J. Houston and A. E. Kennelly before the National Electric Light Association.]

Measuring the illumination rather than measuring the intensity of separate lamps would remove a source of great annoyance both to electrical engineers and to municipalities, by rendering unnecessary discussions as to the candle power of incandescent or arc lights employed, since if the contract between the city and the lighting company be so drawn that the illumination in any part of a lighted street, for example, in the absence of moonlight, shall not be less than a certain minimum, all questions as to the candle power of the separate sources will fail to affect the contract, and it only remains for the electrical engineer to provide such lamps as will, at the spacing employed, give the illumination contracted for.

The difficulty of obtaining a reliable portable standard lamp, the rather cumbersome size of the apparatus, and the fact that it does not obviate the difficulty of comparing illuminations of different colors, have led us to devise a new instrument based on entirely different principles. We call our instrument an illuminometer, and have filed applications for a patent on the same.

A certain intensity of illumination is required to render a definite object viewed at a definite distance clearly delineated to the eye. It is well known that the illumination received upon the printed page of a book or newspaper must have a definite value in order to render the printed characters legible and that the intensity of the illumination so required will, for a normal eye, depend upon the size and character of the print.

We employ this principle in the operation of our illuminometer as follows: A small test object of, say, printed characters, is placed in a darkened box, sufficiently small to be readily carried in the pocket. The test object is exposed to illumination received from a translucent plate of porcelain or opal glass, which receives directly on its surface the illumination whose intensity is to be measured. Since the test object

receives the light from this plate by transmission and subsequent diffusion, it is the area of the translucent plate exposed to the test object in order to just render the latter legible to the eye that determines the intensity of illumination upon the plate. A focussing eyepiece is placed opposite the test object for purposes of annulling the effect of any focal abnormalities of vision. A sliding shutter movable by a milled-headed screw permits the effective area of the opal glass plate to be reduced until the amount of light received by the test object just permits of its legibility.

The total length of the instrument is 5½ inches, its breadth is 1.5, and its height, excluding the milled-headed screw is 2½ inches, so that the apparatus can readily be carried in the pocket. Its weight is 10 ounces.

It might be supposed that two different observers having different limits of distinct vision would obtain different results in determining a given illumination by the use of our instrument. In point of fact, however, we find that by the use of the focussing eyepiece, distinct vision of the test object being readily secured for each observer, the results of different observers do not appear to differ by more than the limits of probable error for the apparatus.

It will be evident that the advantage of such an instrument consists in the fact that it entirely dispenses with the necessity for the use of a portable standard of light, thus removing a constant source of unknown error in apparatus previously employed for this purpose. Moreover, the instrument does not require any great skill in its use, and with simple directions for use can readily be employed by an inexperienced observer.

It is evident that our illuminometer will permit a direct determination of the candle power of a source of light by measuring the illumination produced at a fixed distance by that source of light alone. Thus, for example, if an incandescent lamp has its illumination measured at a distance of 1 meter from the center of the filament, the number of luxes indicated by the instrument, when its window is perpendicular to the rays from the lamp, and all other sources of light are well cut off, will give directly the number of international or decimal candles in the lamp. It is, therefore, possible to measure the candle power of a lamp in its socket, provided all other lamps in the neighborhood be extinguished, and that a black non-reflecting cloth be placed so as to prevent any appreciable amount of light from entering the windows except that radiated directly from the lamp.

Our illuminometer, therefore, becomes indirectly a portable photometer.

Apart altogether from the use of our apparatus, the National Electric Light Association doubtless recognizes the fact that there exists to-day no generally accepted standard of illumination. We would respectfully recommend that the Association consider the advisability of adopting as the unit of illumination the lux, or bougie-meter, *i. e.*, the illumination produced by a decimal candle at a distance of a meter. This unit has been under consideration for some years, and has been provisionally adopted by several writers in this country and Europe.

Discussion.

Professor Elihu Thomson thought the question of the measurement of illumination resolved itself into a physiological one. We know that visibility depends on contrasts. Our eyes take time to respond to sudden changes of illumination. It would be hardly proper to measure everything by legibility, depending on time of impression, because the illumination as to rate may come in there.

Another criticism he made was that the printed slip could be more easily read after it was used a while on account of becoming familiar with the matter, and to change the printed slip every time might involve a change in the character of the surface. It was a question in his mind whether the paper would maintain its integrity as a surface for receiving and diffusing light. Paper is darkened by age.

Another question was the ability of the iris in different individuals to respond to light. Do the eyes have the same aperture to receive light? He doubted it. Then comes the question of color blindness. He referred to these points as indicating the necessity, before adopting a method like the one under consideration, of comparing results of a large number of observations to find out whether there was a difference to be noted, or whether we could rely upon a fair average result.

A. E. Kennelly—In regard to what Professor Thomson has so eloquently explained with reference to the unfortunate power of our eyes, I grieve that our eyes should be open to such grave impeachment, and, in fact, I am only glad, after reading of the troubles to which we may be liable, that we have anything which we may call eyes at all. No two eyes see alike, and it is not possible to get an instrument, based on the agency of the eye, to be absolutely correct; but, on the other hand, I am pleased to remember that our eyes have some definite value, and just in so far as our eyes are perfectly normal, just in so far can we conduct the measurements relied upon.

How I Fire My Boilers.

By J. B. Cowles.

Getting up steam and keeping up steam are not duties which call for a very high order of intelligence, yet intelligent performance of the duties means economy, and therefore profit for the owner. Intelligent, studious thought, experiments innumerable and costly, have been and still are being undertaken to devise a steam generator which shall typify perfection. Grate surface, chimney area, direction and application of the heat evolved from combustion, circulation within the generator, methods and devices for feeding the water and taking away the steam for utilization, all have occupied and still occupy the best thought of the professional engineer, and unquestionably a greater degree of efficiency in steam generators is resulting, but perfection in actual service is yet a long way off, and perhaps will never be attained.

Many excellent dissertations upon the proper methods of firing have been given wide publicity through the technical press, and many a fireman is justly proud of the skill he has attained in his particular calling; but how often, after the exercise of his best skill, have the results been wholly unsatisfactory; how often has he found it almost impossible to make steam rapidly enough to fill the needs of the engineer? A variation in the quality of his fuel may cause him infinite trouble and excessive labor, and this variation is continually presenting itself. It is a stumbling block in the path of the seeker after the ideal in steam generation, and it is the bane of the careful, painstaking fireman.

Experiments carefully made have shown very considerable variations in the heat given out by coal, taken at different times from the same vein, although combustion was accomplished each time under identical conditions.

Very noticeable differences in economy of performance have been observed, too, in steam plants of practically similar character, operating in different sections of the country, and this difference is directly traced to the difference in fuel character—*i. e.*, in the character of the coal. Exceptionally excellent and economical performance of a steam plant in Pennsylvania would not therefore signify equally economical performance in Indiana, unless the same fuel was employed.

But there is another thing which has much to do with a boiler's efficiency, to which general attention has not, I think, been sufficiently strongly directed—viz.—fuel size. An even fire is impossible with coal of greatly varying size, and everybody knows that the very nature of bituminous coal renders it difficult to handle and still preserve anything like uniformity of size, yet it is not impossible to do so. Perhaps some reader may be interested in knowing how I accomplished it. Our boiler room is 6 ft. lower than our engine room, and about 11 ft. lower than the ground upon which our railroad siding is laid. Two years ago it was the custom to run a car or two of coal up to the chute and dump onto the boiler room floor.

It became necessary to make some changes in the plant, in the interest of convenience, and lacking boiler capacity to properly heat the mill as well as run it, I put in a battery of two boilers. Instead now of having the coal thrown onto the floor, I built a bin, hopper bottom, and ceiled it tightly from floor to roof of boiler room. This bin discharges into the boiler room exactly midway between the fire doors of each boiler and about 4 ft. above the floor. Extending out from this opening and into the room is a spout, 2 ft. wide at its juncture with the bin and broadening as it enters the room to 3 ft. at its lower end, at a point 5 ft. from the bin. The bottom of this spout consists of ½-inch round iron rods crossing each other at right angles, the openings being 5 in. square. Whatever is too large to pass through this screen passes off the end and falls to the floor. About 6 ins. below this is another screen-bottomed spout, the openings in which are 2 ins. square. One side of this spout follows the line of inclination of the one above it, while the other side drops sharply away from that line, and its inner end reaches within 14 ins. of the floor. This delivers the coal which will not pass through it at one side. Immediately below this spout is another with solid iron (boiler iron) bottom, the side inclination of which is the reverse of the one above it, thus delivering what it receives upon the side opposite to that delivered by the spout above it.

In practice it is seldom that "chunks" larger than 4 inches square find their way through the bottom of the first screen, while the second

screen passes very little larger than inch square pieces. What passes through the top or first screen goes always under one boiler, and the second screen goes to fire the second boiler. What passes off the end of the top or first screen is broken up by the fireman and passed over the screens by the shovelful, to "size" it.

Contrary to what I was assured would be the result, I have had no trouble of any kind, my grate bars are as good and perfect as they were the day I put them in, 14 months ago; there is no slag or accumulation of any kind upon them. My ashpits are large and roomy, and are kept clean, and the "draft" of my chimney is reliable. We regulate intensity of fire by the dampers almost entirely. Of course the boiler fired with the finer coal, slack and dust requires more frequent attention from the fireman than does that fired with the larger coal, but we have no troble with combustion.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

UNDER the able management of Mr. Thomas Dunderdale, who has been in charge of the affairs of the Ottowa (Ont.) Gas Company since September, 1893, the Company has made a great many improvements, and has increased its gas sales over January, 1892, by no less than 18 per cent. Among the improvements in the works during the past season we notice the placing of a second set of the Economical Gas Apparatus Construction Company's improved carbureted water gas apparatus, with a capacity of 250,000 cubic feet per diem, which system is working satisfactorily, and the construction of four sets of purifying boxes, 16 feet square, with 30 inch seals, with traveling hoist for covers and patent center seal, whereby one, two, three or four boxes can be worked as desired, and 12 inch yard connections. Mr. Dunderdale, the previous season, overhauled and repaired about three miles of old mains, and laid about four miles of new mains, of 4 inch, 6 inch and 8 inch diameters, besides putting in scores of new service pipes. The old mains were in very bad condition, as will be understood when it is said that the leakage amounted to 40 per cent. when he took hold of the works, but Mr. Dunderdale's persistent searching has brought the leakage account down to 15 per cent. Further, he says he will not be satisfied until the loss from this cause is returned at 10, or even 8 per cent. Among other betterments for this year under consideration is the construction of a gasholder, to be covered with a brick house and iron roof, the rated capacity of the vessel to be 200,000 cubic feet. This looks like good business, and it is a certainty that Mr. Dunderdale is right up to the times.

IN reply to "A. S. B.," of Trenton, N. J., the bill to increase the salaries of the Board of Gas and Electric Light Commissioners, of Massachusetts, proposes to add $500 per annum each to their respective present compensations; the Chairman, $3,000, and his two colleagues $2,500.

THE following preamble and resolution were recently introduced by Ald. Henney at a meeting of the Hartford (Conn.) Council, the latter indorsing the same by a majority vote:

Whereas, The safety of the community has been imperilled by escaping gas, owing to an accident at the works of the Gas Company; and

Whereas, It is desirable that some city officer or functionary should have the power to take all needed steps for the public protection in such emergencies; therefore be it

Resolved, That the City Attorney be and he hereby is requested, if the matter be not already covered by the provisions of the proposed new city charter, to see that proper legislation in connection with the new charter is submitted to the Committee of the General Assembly, conferring the necessary power upon some city officer to prevent a repetition of the danger referred to.

THE usual annual order to enable a sub committee of the Committee on Manufactures of the lower branch of the Massachusetts Legislature to inspect the gas works of Philadelphia, Richmond (Va.) and Chicago has been introduced.

THE proposals submitted by the Troy (N. Y.) Gas Light Company for the public lighting of that city are as follows: Public gas street lamps, 8 cents each per night for a one year contract; 7¾ cents per night for two years; 7½ cents per night for three years; gas to city buildings, $1.50 per 1,000 for one year; $1.45 per 1,000 for two years; $1.40 per 1,000 for three years; public electric arcs, 50 cents per lamp for one year; 46 cents per lamp for two years; 39½ cents for three years; for current to incandescent electric lamps, one-half cent per ampere hour, not exceeding double the number of lamps now in use, in which case three-quarter cent will be charged.

THE Citizens Co-operative Gas Company, of Chicago, the articles incorporating which were filed last fall, has evidently been spurred to activity by the passage of the Ogden gas ordinance. Our belief that such is the case is based on the issuance by its backers of the following prospectus—the "Co-operative" is not yet the possessor of a franchise from the city: "This Company has been incorporated under the laws of the State of Illinois for the purpose of manufacturing and selling gas. With the present low price of material and labor, a first-class modern plant to equal the output of the Gas Companies owned by the gas trust (stocked and bonded for over $50,000,000), on which they pay a dividend of 6 per cent., can be built for $15,000,000. To enable the citizens of Chicago to own their own gas works, and get their light and fuel at the lowest possible price, the stock is offered to the public at the par of $10 per share (payable $2.50 on application, balance as the work progresses), the object of the Company being to have the stock distributed in small amounts among consumers, instead of being owned by a few capitalists. At the present price of gas, $1.15 per 1,000 cubic feet, this Company can pay a dividend of 50 per cent., though the Directors purpose charging not over 75 cents, which will enable them to pay a dividend of not less than 25 per cent. to the stockholders. Why pay this to a monopoly? Let the consumer have it instead. The only way to kill monopoly is by co-operation. As an investment nothing safer can be found. Gas Companies never fail; they make no bad debts. No deposit on meters required from stockholders." Only a profit of 25 per cent. per annum on an investment of $15,000,000, in selling gas in Chicago at 75 cents per 1,000 cubic feet! They might just as well have put it at 50 per cent. and only have been a trifle farther away from the truth, even if they manufactured and sold every foot of gas used in Chicago.

THE Poughkeepsie (N. Y.) Electric Light and Power Company has placed the contract for its new plant with the Berlin Iron Bridge Company, of East Berlin, Conn. The engine and dynamo room will be 61 feet wide and 172 feet long, the boiler room to be 77 feet wide and 60 feet long, and the structure will be covered with the Bridge Company's patent anti-condensation corrugated iron roofing.

THE bill to repeal the exclusive feature of the franchise of the Milwaukee Gas Company, after due consideration by the Assembly Committee on Incorporations, has been reported for indefinite postponement, which means that it is defeated.

MESSRS. George W. Shreck, George R. Reed, S. H. Sedgwick, H. C. Page, A. J. Given and A. C. Montgomery have filed articles incorporating the York Light and Power Company, for the purpose of furnishing light, heat and power by the use of gas and electricity in the city of York, York county, Neb. The capital stock is put at $12,000, and the Company cannot incur an indebtedness exceeding 66 per cent. of the capital stock. The chartered life is put at 50 years. This place is on an affluent of the Big Blue River, at a point 52 miles west of Lincoln. Three railroads trisect it, and it has a population of about 4,000.

THE Newark and Citizens Gas Light Companies, of Newark, N. J., have notified their consumers that the penalty of 5 per cent. hitherto imposed for failure to pay gas bills within the period of 10 days from the presentation thereof has been abolished.

IT is said that Mr. A. B. Wilgus, who is interested in the construction of an electric street railway for Batavia, N. Y., proposes to purchase the plants of the Consolidated Gas and Electric Company of that place.

MR. H. H. FRANCISCO, for many years the capable Secretary of the Tulare (Cal.) Gas Company, has resigned that post, in order to engage in business in San Francisco.

SENATOR OWENS, of the Kings County delegation, is responsible for a bill which seeks to limit the price that may be charged for electric lights in cities of this State, having a population of 800,000 or over, to ½ cent per hour for each 16-candle power incandescent lamp, and 4 cents per hour for each arc lamp of 2,000 candle power.

IT has been definitely settled that the business offices of the Bridgeport (Conn.) Gas Light Company shall be located in the Library Building on or before April 1st.

A CORRESPONDENT at Vancouver, Wash., forwards the following: "The City Council has at last decided to lease the city electric light plant. The question has been under consideration more than a month by the present Council, and at various times by other Councils for the last four years. The decision to lease was practically arrived at by the Council, acting as a Committee of the whole during the first week in February, but no definite information was gained until Feb. 18, when at the regular meeting of the Council an ordinance was introduced and read the first and second times, authorizing the Mayor to enter into a contract with DeWitt Jenkins and J. W. Harvy for the lease of the plant, and to require bonds of not less than $10,000 for the faithful performance of the contract and for the proper care of the machinery, etc. The lessees are both residents of Vancouver, and are considered thoroughly competent and practical engineers and electricians. About a month ago they submitted a proposition to the Council to assume full control of the plant and pay all expenses, etc., for a term of three years, with the privilege of five, and to maintain and operate 50 arc lights for street purposes at the rate of $2 each per week for 12 o'clock lights and $2.50 for all-night lights."

THE Washington Gas and Electric Company, of Washington, O., will make notable extensions to its main system this season, for the purpose of supplying gas in territory hitherto overlooked. President Penn has also made up his mind to push the sale of gas for cooking and power purposes, and as an incentive to such use the rate for fuel and power gas has been put at the extremely liberal figure of $1 per 1,000. The Company is putting in an incandescent electric light plant, in addition to the arc system that it has operated for some time, and the power for the same is to be furnished by a gas engine of large size.

MR. ROBERT T. LINCOLN has been elected President of the Chicago Gas Light and Coke Company, vice Mr. E. J. Jerzmanowski.

CERTAIN schemers are said to be anxious to secure a gas franchise for Syracuse, N. Y.; but as those behind it are interested in the Wilder gas process, we imagine their chance is not a good one.

THE new boiler house for the Stanley Rule and Level Company, of New Britain, Conn., was designed by the Berlin Iron Bridge Company, of East Berlin, Conn. The side walls are of brick, the floors of iron, and the roof of iron, covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron.

THE Boston *Herald*, of the 1st inst., said: "The Citizens Gas Company, a corporation recently established to furnish $1 gas to the residents of Medford, was granted a hearing last evening in the Aldermen's room in Medford City Hall on its petition for permission to open the streets of the city for the purpose of laying mains. Alderman Walter F. Cushing, the President of the Company, said in his opening remarks that the Company meant business and proposed to erect a plant on the Mystic river and manufacture gas to be distributed to the citizens for less than $1 per 1,000 feet. Mr. Loomis, an expert, claimed that gas could not be manufactured for illuminating purposes for less than $1, but for cooking purposes it could be made for less. Mr. Jennings, Manager of the Framingham Company, explained the methods in use in his own town. A number of remonstrants appeared, including W. W. Tifula, a large real estate dealer; Eleazer Boynton, D. W. Wilcox, City Solicitor Hayes, as an individual, and J. Gilman Waite. They claimed that another Company was not necessary, as the Malden Company was giving good service at a reasonable price. Mr. Waite and Mr. Tifula asked that their names be stricken from the petition, as they claimed they were obtained fraudulently. President Cushing, in closing, stated that he was perfectly willing to abide by the decision of the Board, and on being asked how many miles of pipe would be laid, he said 14 miles would be laid in two months. The incorporators of the new Company are Warren Sawyer, Chas. Lee, Frank D. Allen and James Niver, of Boston, and W. S. Cushing and Henry E. Turner, of Malden. It is capitalized for $50,000. The Committee took the whole matter under advisement."

AT a meeting of the Society of Chemical Industry (New York section), held in the amphitheater of the College of Pharmacy, 115 West 68th street, this city, on the evening of March 4, an exhibition of some of the uses of calcium carbide and acetylene gas, as applied to illuminating purposes, was given by Messrs. T. L. Willson and J. J. Suckert. Owing to the early starting up of the generating vessel, before the gentlemen were ready to begin their remarks, the acetylene gas more than filled the experimental gasometer, which commenced to blow, and thus gave the audience in a few moments an opportunity to become familiar with the odor of acetylene gas, which they will hereafter be able to recognize without trouble. There was another slight mishap in losing control of the ammonia machine (in an adjoining room), which was being used to freeze a quantity of the liquefied acetylene gas, and which allowed a large quantity of the ammonia vapor to escape into the lecture room, causing the audience to weep perceptibly, but thereafter the discourse proceeded without serious interruption. The exhibition of the acetylene gas burned in half a dozen special burner tips gave a very fine effect in itself; it was then compared with another half dozen jets of city gas side by side, whereupon the city gas got decidedly the worst of the comparison, though, to be sure, the gentlemen could hardly have been accused of being over particular in their selections of the burners used for the city gas. Among the interesting exhibits was the putting of a small quantity of carbide into a tumbler of water and the burning of the gas as it was given off, due to the decomposition of the carbide of calcium forming acetylene gas and lime. Another experiment was the freezing of a quantity of mercury in a saucer by covering it with some of the liquefied gas, which itself had been previously frozen or solidified into a sort of snowy constituency by the use of ammonia. Some of the frozen gas showed a temperature of 117¼° below zero. An attempt was made to burn some of the acetylene gas mixed with air in the proportion of 60 per cent. of the former to 40 per cent. of the latter, in ordinary gas burners; but the apparatus would not work satisfactorily, and only the acetylene gas came through, which, without the air, burned with the evolution of much dense smoke or lampblack, which afterwards settled over the audience in small flakes. The claims made for the gas in regard to its use for illuminating purposes alone and in combination with city gas as an enricher, as well as the claims they made as to the cost of producing the carbide of calcium, were, to say the least, somewhat visionary, and, I should say, could hardly be substantiated, even in theory or practice. The Chairman of the Society made the remark that it seemed that the gentlemen having the enterprise in hand had "cooked their hare before they had it caught." Dr. C. F. Chandler, of Columbia College School of Mines, when asked to say something about the new gas in connection with illumination, said he had nothing to add to what had already been said. Dr. Elliott, of the Consolidated Gas Company, said that the possibilities of acetylene gas in various scientific and industrial ways were great and almost fairy-like. Mr. Allen, of Boston, who asked if someone present could not give information as to the amount of acetylene gas necessary to raise the candle power of coal gas, and as to the comparative effects that it produced in coal gas and water gas, was unable to get a satisfactory reply. The exhibition, however, was, on the whole, interesting and was agreeably received by the audience.

HE is a wise man who starts his work early, and Superintendent F. H. Parker, of the Burlington (Vt.) Gas Light Company, is proving himself such by having already commenced actual work upon no less an undertaking than an entirely new gas manufacturing plant for his city. In other words, as was noted some time ago in the JOURNAL, the old gas works having been outgrown, the Burlington Company has purchased a large tract of land, with every facility as to railroads, canal, drainage, water supply and general location that could reasonably be desired, and will this season erect thereon a complete modern 10-inch water gas works, from foundations to weather vanes. The general engineering plans, specifications and arrangements are being prepared by the United Gas Improvement Company, which Company has also contracted for the new generating apparatus, purifiers and other ironwork. Local contractors will erect the buildings, for which the Berlin Iron Bridge Company will provide roofs, railroad trestle, etc. The relief holder system will be operated in connection with the present gasholder from the old works, re-located, and a commodious new one will be put in for general storage purposes. Both holders will be housed in brick structures, as the rigors of winter in Northern Vermont are not to be slighted. The capacity of the new generating machinery will be one-quarter million cubic feet per diem, and it goes without saying that it will be an up-to-date specimen of the United Gas Improvement Company's standard setting of Lowe apparatus. It will be supplemented by a second set alongside, consisting of the present water gas apparatus from the old station, removed and renovated. The new purifiers will measure 9 feet by 13 feet, the meter, exhauster and other parts being in due proportion; so that, taking it all in all, Superintendent Parker is expecting by midsummer to have about as neat, commodious, attractive and efficient a plant as can be found anywhere in his section—or in any other, for that matter.

THE AMERICAN GAS LIGHT JOURNAL

MONDAY, MARCH 11, 1895.

The Market for Gas Securities.

Consolidated ruled steady during the week, the opening quotation of to-day (Friday) being 131 bid, offered at 132, which, of course, is ex-div. of 2 per cent. Other city shares are strong, notably Equitable and Mutual. East River common is at 22 bid, with some inquiry for it. Northern 5's are offered at 98. Consolidated shares are a purchase, for the defeat of the Coffey rate bill for Brooklyn assures virtually no change in the rate for this city. Brooklyn shares are as before, and the people in control there are not bothering themselves at all over Assemblyman Wray's bill to prevent consolidation. Chicago gas is weak, although the reorganization has been to all intents and purposes accomplished. It is cheap at anything under 80. New Jersey shares of all classes are higher. Bay State incomes are offered at 25, and Boston United 2nds are weak at 47, bid. The common stock is at 15½, which shows something of a gain. The Company's affairs are all in a tangle, and ex-Mayor Matthews, as Manager, has his hands full. Baltimore Consolidated is inquired for at 62¾.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

March 11.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	131	132
Central	500,000	50	—	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	181	183
" Bonds (6's)	1,000,000	—	107	—
" " (5's)	.....		111	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	153	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	150,000	50	—	—
" Bonds	150,000	—	94	98
N. Y. & East River Gas				
Common	5,000,000	100	22	25
Preferred	2,000,000	.....	40	44
Bonds	3,500,000	100	83	85
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	37	40
Preferred	5,000,000	100	89	91
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	—
Citizens	1,200,000	20	65	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	175	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	85	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	165	—
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	200	—
" Offs	700,000	1000	99	100
Williamsburgh	1,000,000	50	190	—
Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	15½	15⅝
Income Bonds	2,000,000	1000	—	25
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	72½	74⅛
2d " " "	3,000,000	1000	46	47
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Chicago Gas Company.	25,000,000	100	71⅛	72
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	93	93½
Columbus, O, Gas Co.	1,069,000	—	—	—
1st Mortgage	1,085,000	—	—	—
Consumers Gas Light Co., Jersey City	2,000,000	100	70	75
Bonds	600,000	1000	94	98½
Cincinnati G. & C. Co.	7,000,000	100	—	203¾
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			9	100
Capital, Sacramento, Cal			—	50
Consolidated, Balt.	11,000,000	100	62¾	—
Mortgage 6's	3,600,000	—	107	107½
Chesapeake 1st 6's	1,000,000	—	—	—
Equitable " "	910,000	—	—	—
Consolidated 1st 5's	1,490,000	—	—	—
Detroit Gas Co	4,000,000	.....	18	—
Con. Bonds	4,312,000	.....	—	—
Equitable Gas & Fuel Co. Chicago, Bonds	2,000,000	1000	—	101
Fort Wayne Gas Co.	2,000,000		74	75
Bonds	2,000,000		81	82
Hartford, Conn	750,000	25	120	128
Indianapolis Gas Co.	2,000,000	—	135½	137
Bonds 6's	2,650,000	—	102¾	—
Jersey City	750,000	20	190	200
Lafayette Gas Co., Ind.				
Stock	.....		86	—
Bonds	.....		86	—
Louisville, Ky.	2,570,000	50	—	130
Laclede Gas Light Co.				
St. Louis, Mo.	7,500,000	100	25	26
Preferred "	2,500,000	100	82	84
Bonds	9,034,400	1000	93¾	94
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	—	100
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn		25	200	—
Oakland, Cal.			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City	500,000	—	167	173
Paterson, N. J.		25	99	102
Rochester Gas and Elec.				
Lt. Co.	2,150,000	50	80	85
Preferred	2,150,000	50	81	—
Bonds 6's	.....	—	—	—
Consolidated 5's	.....	—	—	—
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co.				
San Francisco, Cal.	10,000,000	100	72½	72¾
Washington, D. C.	2,000,000	20	240	—
Western Gas Co., Milwaukee	.....	100	44	46
Bonds	.....		83	84
Wilmington, Del.	500,000	50	188	190

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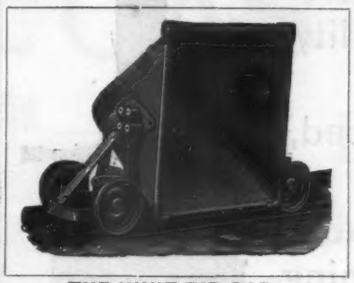

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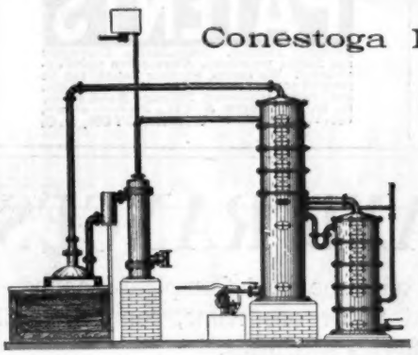

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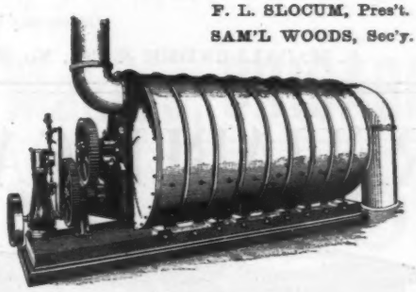

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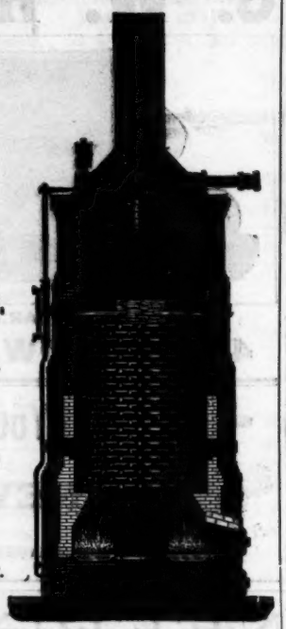

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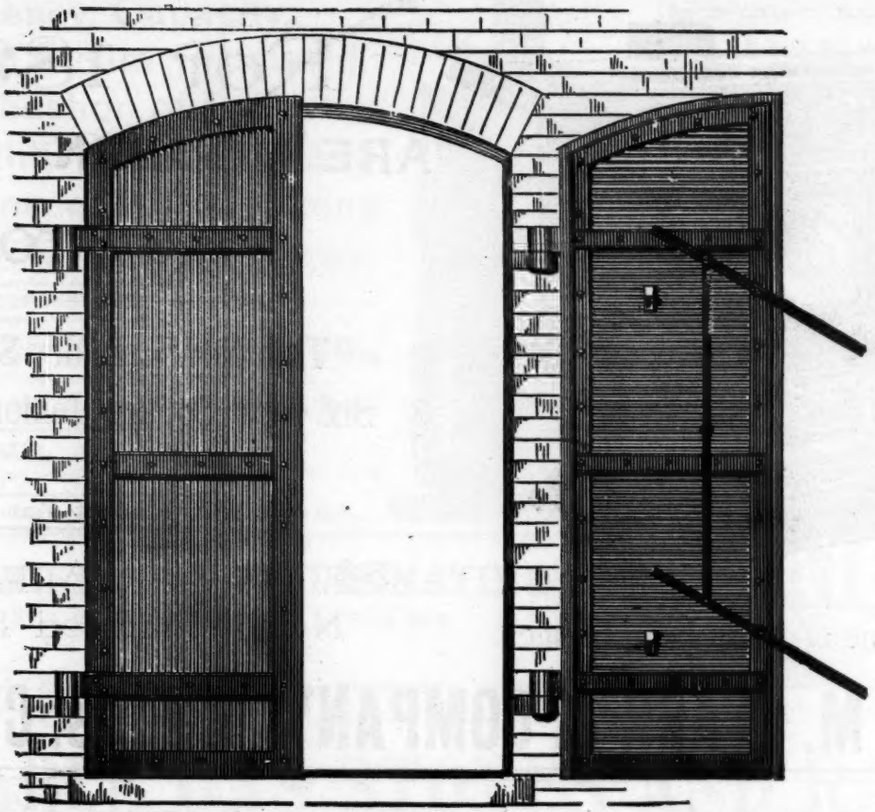

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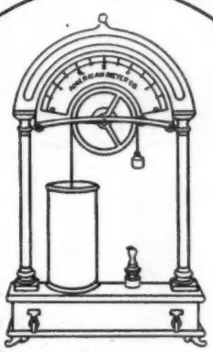

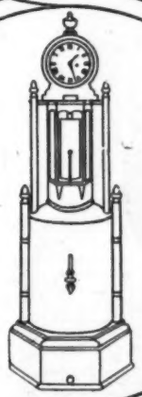

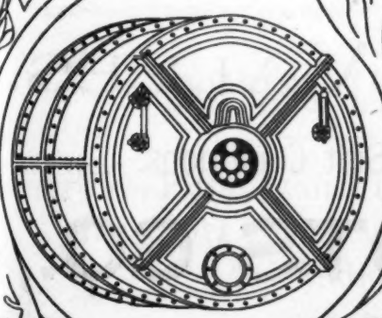

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SAN FRANCISCO.

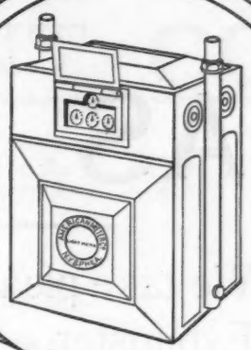
PUBLIC LIGHTING TABLE.

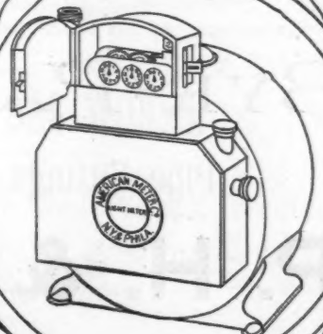
MARCH, 1895.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	10.10 PM	5.40 AM	5.30	5.45
Sat.	2	11.20	5.40	5.30	5.45
Sun.	3	12.20 AM	5.30	5.30	5.45
Mon.	4	1.30 FQ	5.30	5.30	5.45
Tue.	5	2.30	5.30	5.40	5.35
Wed.	6	3.20	5.30	5.40	5.35
Thu.	7	4.00	5.30	5.40	5.35
Fri.	8	4.40	5.30	5.40	5.35
Sat.	9	No L.	No L.	5.40	5.35
Sun.	10	No L. FM	No L.	5.40	5.35
Mon.	11	No L.	No L.	5.40	5.35
Tue.	12	6.40 PM	9.10 PM	5.50	5.20
Wed.	13	6.40	10.30	5.50	5.20
Thu.	14	6.40	11.40	5.50	5.20
Fri.	15	6.40	12.50 AM	5.50	5.20
Sat.	16	6.40	2.00	5.50	5.20
Sun.	17	6.40 LQ	3.00	5.50	5.20
Mon.	18	6.40	3.50	5.50	5.20
Tue.	19	6.40	4.30	6.00	5.10
Wed.	20	6.40	5.00	6.00	5.10
Thu.	21	6.40	5.00	6.00	5.10
Fri.	22	6.40	5.00	6.00	5.10
Sat.	23	6.40	5.00	6.00	5.10
Sun.	24	6.50	4.50	6.00	5.10
Mon.	25	6.50 NM	4.50	6.00	5.10
Tue.	26	6.50	4.50	6.10	4.55
Wed	27	6.50	4.50	6.10	4.55
Thu.	28	6.50	4.50	6.10	4.55
Fri.	29	6.50	4.50	6.10	4.55
Sat.	30	10.20	4.50	6.10	4.55
Sun.	31	11.20	4.40	6.10	4.55

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45





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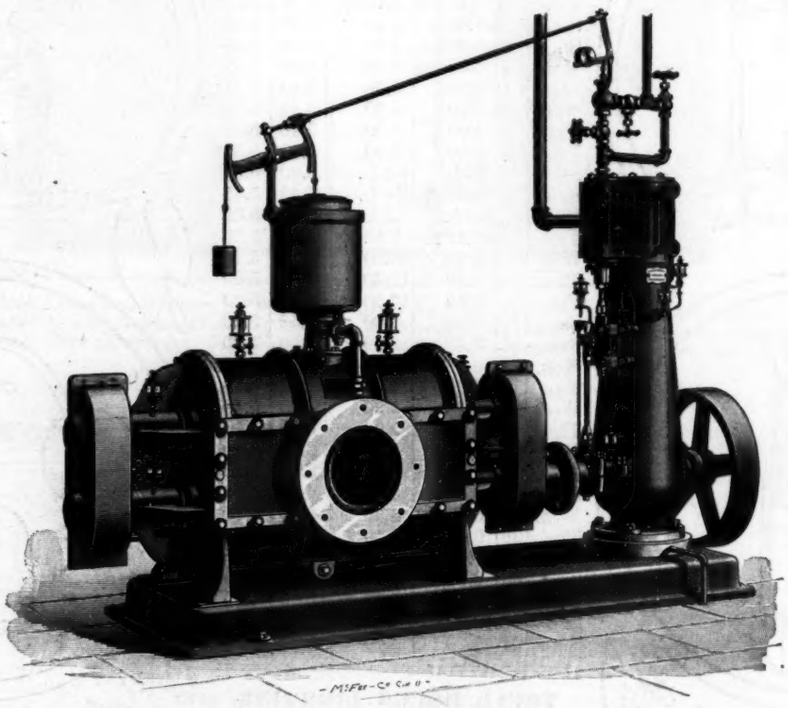

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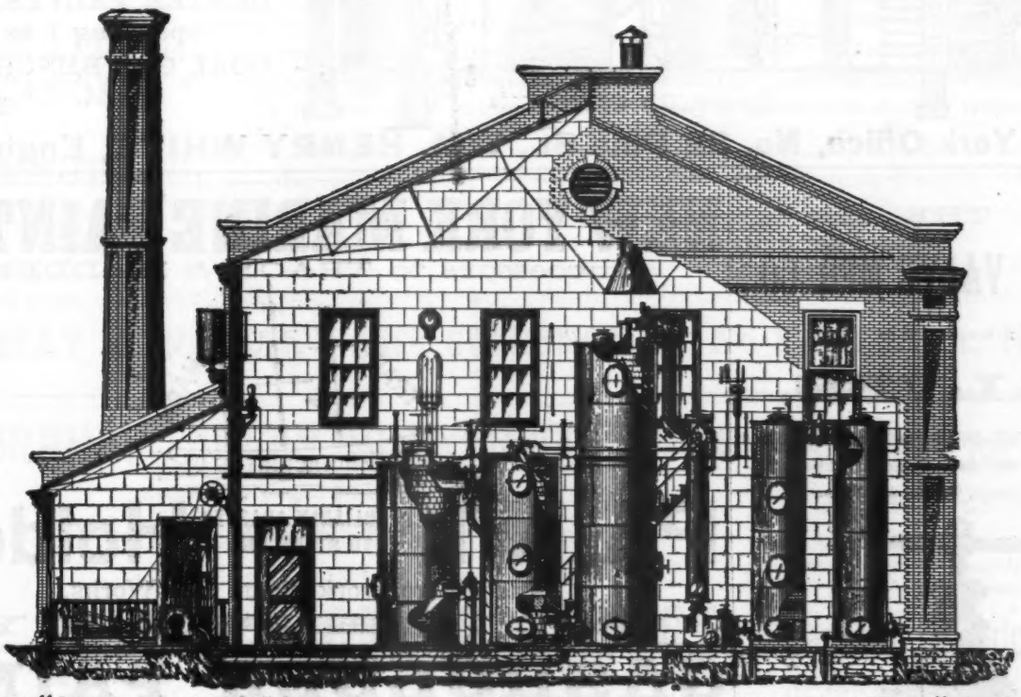

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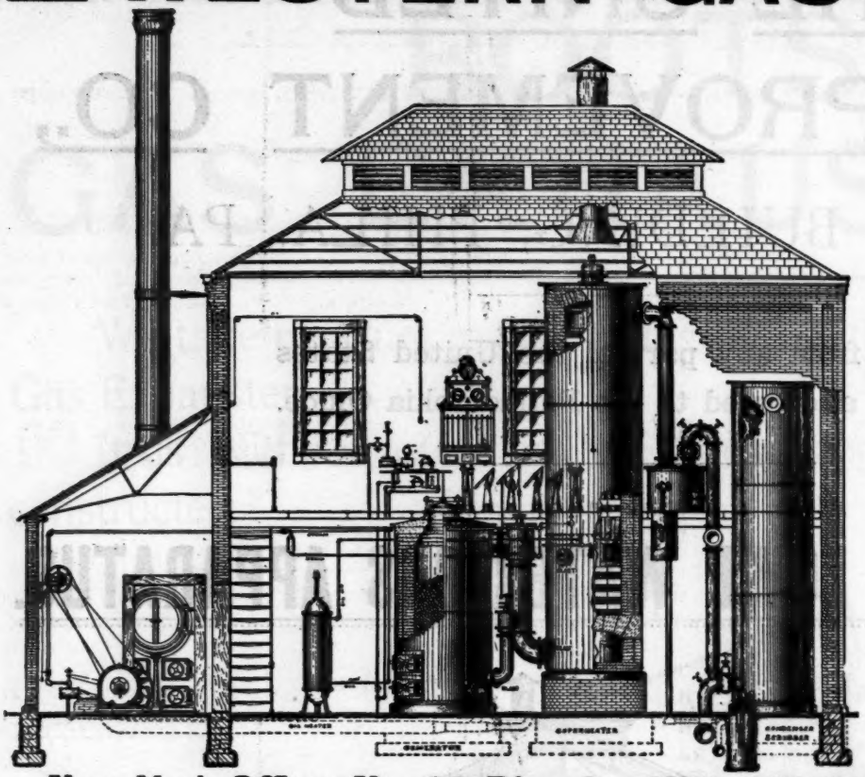

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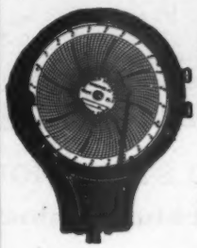

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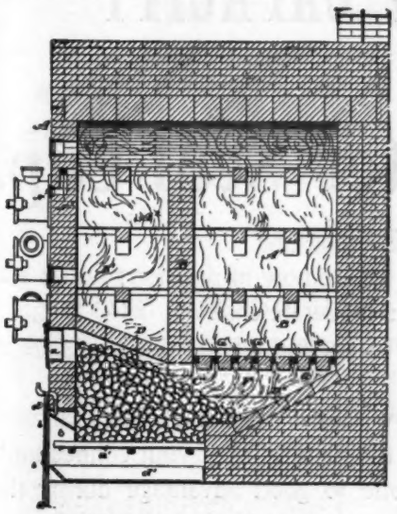

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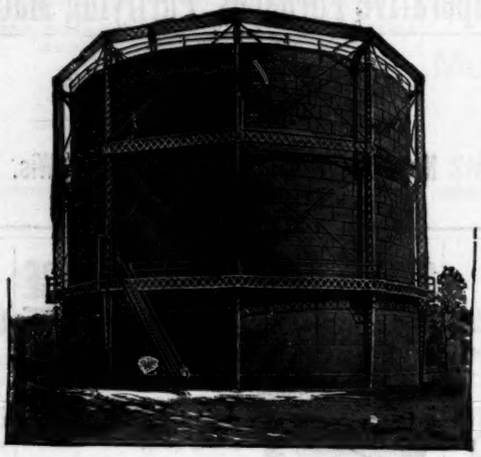

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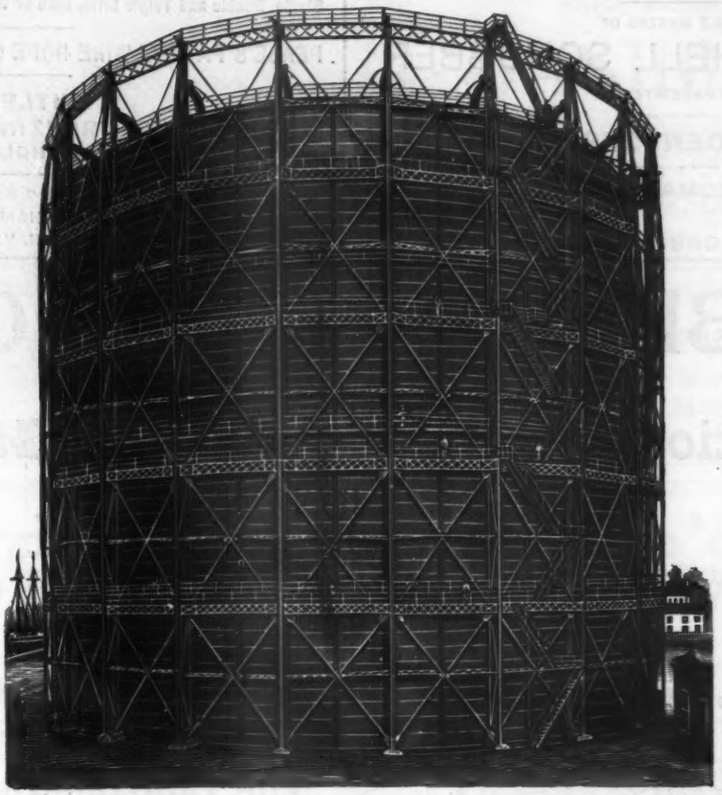

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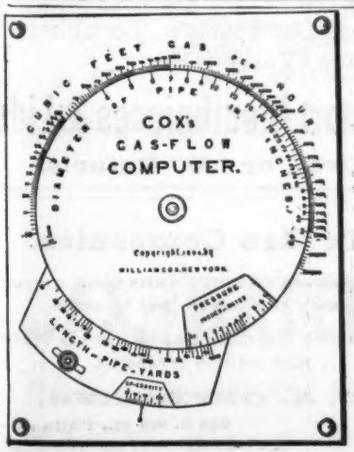

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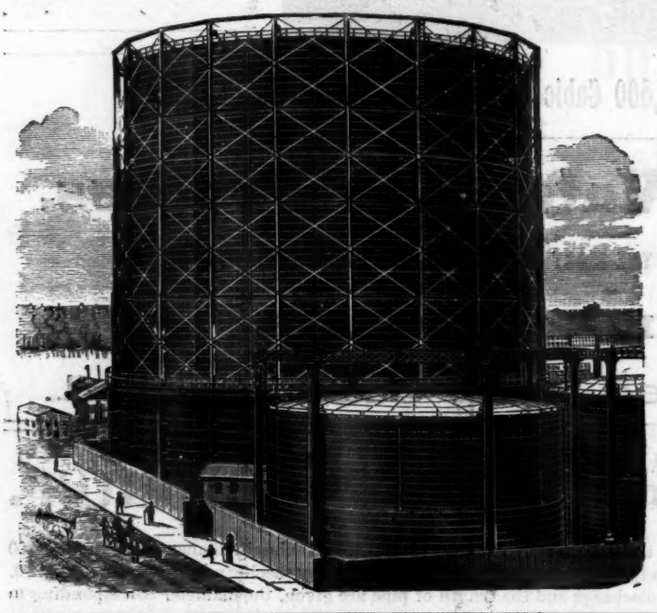

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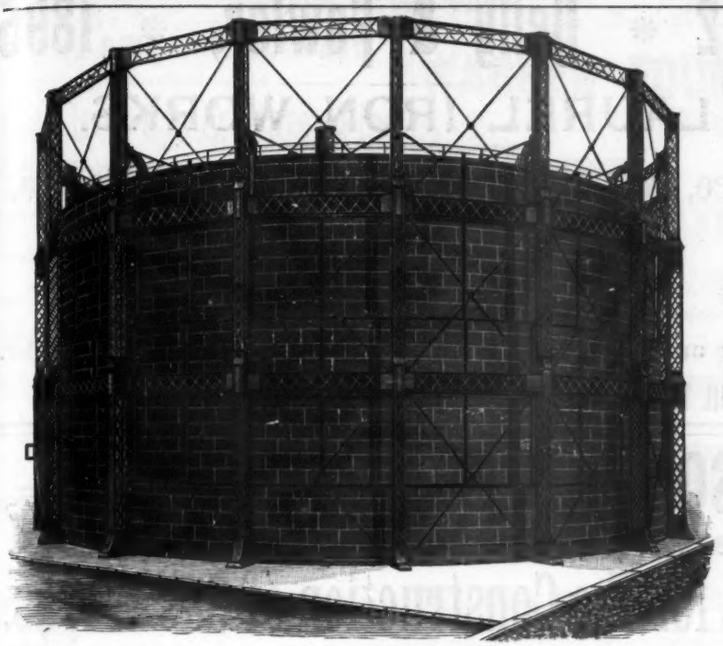

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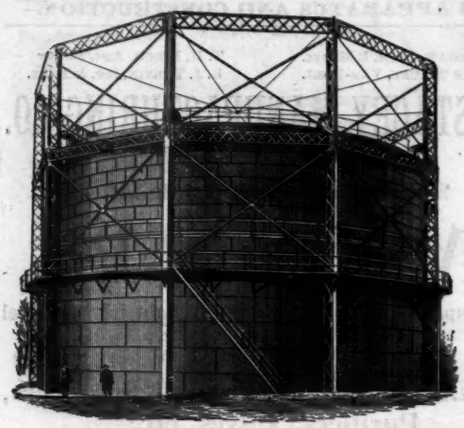

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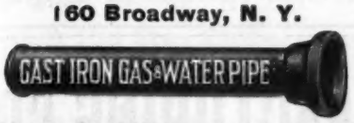

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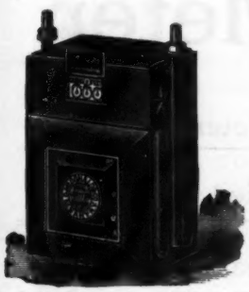

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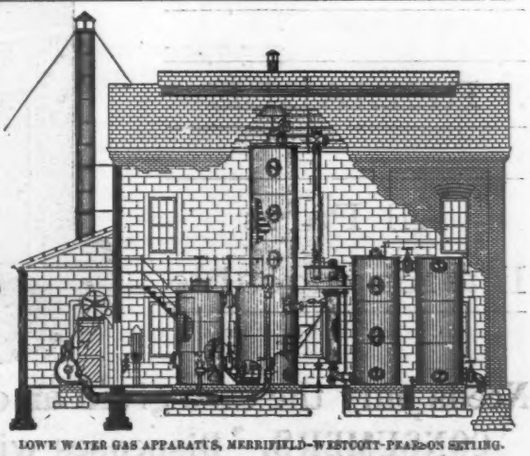

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